Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LII. NEW YORK, SATURDAY, JULY 4, 1908. No. 1.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....4.50
Other Foreign Countries within the Postal Union.....6.00
25 shillings 25 marks 31 francs
Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Copyright, 1908, by McGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of ELECTRICAL WORLD *for 1907 was 951,250 copies, an average of 18,294 copies per week. Of this issue 21,000 copies are printed.*

NEW YORK, SATURDAY, JULY 4, 1908.

CONTENTS.

Editorial 1
Retail Lighting Contract in New York 4
Convention of the American Institute of Electrical Engineers 4
Amount of Electrical Energy Generated in Chicago 5
Fuel Investigation and Smoke Problem 5
Street Lighting in St. Louis 6
Convention of National Electric Contractors' Association 6
Cleaning Tungsten Lamps and Reflectors 7
Convention of Iron and Steel Electrical Engineers 7
Commutator-Motor with Stationary Armature 7
Application of Long Acre Company 8
Hearing on the Proposed Accounting System for New York Electrical Corporations 9
Convention of Railway Telegraph Superintendents 11
Current News and Notes 12
Illumination of the Singer Tower 13
Electric Light and Power at New London, Conn. By William H. Stuart 15
Alternating Current Motors and Lamps for Industrial Plants. By Warren H. Miller 16
Cost of Producing Electrical Energy. By Edwin D. Dreyfus 19
Double-Deck Steam Turbine Generating Stations 21
Liabilities for Accidents Due to Fallen Wires. By John E. Brady 21
Wiring from the Contractor's Standpoint 23
Wave Wiring for Direct-Current Armatures. By George T. Hanchett 24
The Use of Culm by Central Stations 24
Emergency Repairs to Steam Pipes. By William Kavanagh 25
Automatic Damper Regulators—III. By W. H. Wakeman 26
Letters on Practical Subjects 28
Questions and Answers 33
Non-Peak Central-Station Load at Marion, Ind 34
New Business Methods at Scranton, Pa 36
The Tungsten Lamp 37
High-Efficiency Lamps in Boston 39
Effective Advertising 40
Relations of the Central Station with the Public 40
LETTER TO THE EDITORS:
German Central-Station Regulations. Arthur Sachsse 41
Digest of Current Electrical Literature 41
New Apparatus and Appliances 46-52
Industrial and Commercial News 53
General News 57
Weekly Record of Electrical Patents 63

RESTRICTING COMPETITION.

For some time past efforts have been made to set up active competition in the electric lighting field in New York City, where numerous systems once fought for business, but where the service was long since unified and consolidated subject to one management. Under the new régime of regulation by the Public Service Commission, the company which desires to inaugurate competition could not issue its securities without obtaining the sanction of the state, and the commission has now denied the application for such a grant. The ruling imposing a check upon competition of this nature and in protection of a "monopoly" is one of unusual importance, but it cannot be said to be unique. The newly constituted bodies for the regulation of public utility corporations have previously, and with the final approval of judicial opinion, shown themselves ready and willing to act in behalf of an assailed company just as much as on the appeal of a citizen with a grievance, real or imaginary; and results of the first consequence must be realized from the exercise of broad powers of this character.

In its decision, the commission questions the legal title of the competing company to its franchise and objects to the various contracts affecting the work. The amount of new capital proposed was very large, and no equivalent return was to be seen. But the chief grounds assigned for rejection of the application are that new competition is not desirable or necessary for the public welfare, and that absolutely no guarantee is given that the competing system would remain independent for any considerable period. The commission lays down these fundamental principles: "Competition would cause inconvenience and expense to the public, would cause duplication of plant, would lead to waste, and ultimately be used as a reason why rates should not be reduced to consumers." Hence, so long as the possible good effects of competition in improving service and lowering rates can be secured through the exercise of the powers of the commission, without letting the detrimental effects of competition come into play, "it would be unwise to adopt a method which has proved to be ineffective in the past."

It cannot be denied that the newer methods of commission control, now so popular with the public, introduce and make active a condition of efficient reform where before a "monopoly" could be checked only by some process involving "economic waste." If it is proved to be constitutional, this later plan may be found to have within itself many elements of danger and difficulty; but if we are given good public service laws and good commissioners to enforce them, it may be that most, if not all, of the old predatory competition that has done so much to roll up unproductive capitalization, must forthwith cease, with incidental gain to existing investment and public benefit.

The new company claimed in its arguments before the commission to have a better lamp. The decision states that the

commission has the power to compel the present companies to use better lamps, and that the companies have agreed to introduce such improvements. It is the fact that tungsten lamps are now available, and must more and more be open to public use on decent terms. But suppose, for example, that the new company under new patents had exclusive right in New York City to the use of, say, the tungsten lamps, or even to the new lamp which its representatives described so indefinitely. Would the compulsory powers of the commission permit it, under such circumstances, to insist that the old company should use a lamp that it could not obtain under the operation of the patent law and all the decisions that protect a patent company and its licensees? When the new company was willing to supply the public with the lamp to which it had the sole rights, could the commission stand in the way? The ruling essentially is that the present system is doing as well as could be expected, at fair rates, and therefore competition is not needed; but the other point named appears to raise an old issue in a new shape. In other words, how far could such a state commission interfere with the operation of rights and privileges under a national patent?

Tests of 220-Volt Tungsten Lamps Abroad.

As noted in our Digest this week, some very interesting tests of "Just" tungsten lamps for 220-volts have recently been published in the *Elektrotechnische Zeitschrift*. It will be remembered that when the tungsten filament was first produced, there was speculation as to the feasibility of securing filaments of practicable length and small enough cross-section to produce a 110-volt low candle-power lamp. Since tungsten is an element of the metallic group, its resistivity at room temperatures is very much less than that of carbon. Even at incandescent working temperatures its resistivity is relatively low, so that very thin filaments are needed for incandescent lamps. Such filaments, as we know, are likely to break in transportation, or with rough handling. Consequently, it was much easier to produce a tungsten lamp for 55 volts than for 110 volts. Processes of manufacture have, however, so far improved of late, that stronger filaments can now be produced than formerly. It was believed only a year or two ago that it might be desirable to revert to 55-volt distribution circuits for tungsten lamps, in order to permit of retaining the 16-cp unit. That procedure may still be invoked for 8-cp lamps, but for lamps of the ordinary 16-cp standard it would seem that 110-volt service will be entirely satisfactory before long. It may, however, be added that the problem of 16-cp metallic filament lamps is, after all, only an ephemeral one, chargeable to a strange conservation which appears to be descending on the electrical industry. The 16-cp unit was set by the old open-jet gas flame; and while we still adhere to it, our gas friends have advanced to high candle-powers, instead of endeavoring to produce gas mantles that would preserve the former open-flame standard.

Two series of tests of "Just" tungsten lamps are published in the article referred to. One was made at the Physikalish-Technische Reichsanstalt of Charlottenburg, on a dozen 220-volt, 50-hefner lamp with direct current. The other was made at the factory of the manufacturing company, on 10 similar lamps, with alternating currents. The Charlottenburg tests gave a mean life time of 1141 hours, 2 being yet alive at 1600 hours when the test stopped. The lamps started at 50 hefners (44 cp) and rose to a maximum of 51.4 after 100 hours. After that they declined at the rate of 0.1 hefner per 100-hours, so that they were once more at initial normal candle-power after 1400 hours. After this period they declined more rapidly, but the survivors were still at 48 hefners, or at 96 per cent of initial candle-power, after 1600 hours. The specific consumption started at 1.25 watts per hefner (1.42 watts per candle-power) and maintained this rate for 1000 hours, the survivors taking 1.33 watts per hefner after 1600 hours. The factory tests showed a mean life-time of 1224 hours, with one of the 10 left alive after nearly 2000 hours. The lamps started with an average intensity of 48.8 hefners (43 cp) and reached a maximum of 52.1 after 640 hours. Thereafter, their intensity declined slowly. The specific consumption commenced at 1.289 watts per hefner (1.47 watts per candle-power) and improved for 640 hours to 1.231 watts. If we convert these results into equivalents for our standard pressure of 110 volts, we deduce from the article that 22-cp, 110-volt tungsten lamps can be made which will have a mean lifetime of over 1000 hours, and consume about 1.4 watts per mean horizontal candle.

It appears then from these tests that 44-cp tungsten lamps for 220-volts, although slightly less efficient than those for the same intensity at 110-volts, do not suffer in lifetime, or in maintenance of behavior during life. This is a very considerable step. The tungsten lamp not only has the merit of higher efficiency than the carbon lamp, but also the great advantage of having no smashing point. It needs no other executioner's axe than its own filament in the hands of Father Time. It would be a great pity if, in order to secure adaptability to higher voltages or lower candle-powers, this advantage had to be parted with.

Comparison of American and German Standardization Rules from the German Point of View.

A short time ago we published a tabular comparison, from the American standpoint, of the Standardization Rules of the American Institute of Electrical Engineers, and those of the Verband Deutscher Elektrotechniker. About the same date, the *Elektrotechnischer Zeitschrift* published an article, by Dr. Georg Stern, containing a critical comparison of the two sets of rules which discloses the German standpoint in an interesting way. The article, which is abstracted in the Digest, very fairly discusses the relative strong and weak points of the rules adopted in the two countries. In general, it points out that while there are many points of difference in the respective requirements, there are but few that might not be brought into accord, and there are none which differs by reason of radical opposition of principle. The few differences which are ineradicable are matters of established custom, such as standard frequencies of 25 cycles and 50 cycles in Germany, as against 25 cycles and 60 cycles established by manufacturers in the United States—matters that do not now admit of being altered by conventional agreement because of the large capital investments involved. Curiously enough, some of the United States definitions strike the Germans as hair-splitting and polemical, an arraignment that, however mild, might have been expected from our friends in England rather than in Germany. When it comes to refinement of detail and precision of statement, we always accord the palm of superiority to German text-books and investigators. A good criticism of the United States rules

appears in regard to classification of service for machinery. In Germany, there are three types recognized, namely, machines for continued service, machines for brief-period service and machines for intermittent service. The duration of heating test under load is specified differently for these three types. In the United States rules, only the continued service type is recognized, except indirectly, and in such instances as railway motors, which are treated of in a separate appendix. It would certainly seem desirable to give recognition to the three types specialized in the German rules.

It is earnestly to be hoped that the International Electrotechnical Commission, which has already been launched upon the choppy but not tempestuous seas of comparative national standardization, may bring about a harmonious code of international rules in the near future. Certain questions, such as alternating-current frequencies, and the sizes of machine parts, should preferably be omitted from discussion, or from attempts at international regulation. These questions are fortunately of secondary importance only. What electrical engineers all over the world need is a uniform universal code for determining conventionally the rating and duty of electrical machines, and the means by which the properties shall be measured. It is incongruous to the verge of farce that the same machine should be of one kilowatt rating in one country and of another kilowatt rating in another. Yet that is literally the case at the present time. One might imagine that the watt had a different size in different civilized countries, to judge by machines whose rating in watts is locally assigned by official authority.

SOLICITING FOR OUTLINE LIGHTING.

A plan which has been used to a limited extent by solicitors and central-station managers in getting contracts for the outline lighting of buildings is so easily worked and so effective that it should be more extensively used. The plan, in brief, is to obtain a dark print of a photograph of the building to be outlined, prick holes with a cambric needle in the photograph at the points where it is proposed to place lamps, and mount the photograph like a transparency sign in the front of a box containing lamps. Any photographer, from a negative of the building, can finish up a dark print suitable for this purpose. The result will be surprisingly attractive and suggestive to the prospective customer, and will be more effective than a lot of expensive drawings or hours spent in solicitation by argument.

ELECTRIC ADVERTISING.

It is a good business policy that a number of the larger central stations are pursuing in talking and billing electrical energy used in show-window, sign, outline and display lighting as "electric advertising." In fact, one could almost go further and consider a large portion of the energy used in lighting the interior of a store as advertising. The show-window is manifestly an advertising scheme, and one of the greatest publicity value to the merchant. To get the most value from it, however, the window must be flooded with light at night. Sign, outline and decorative lighting is manifestly advertising. While it makes, of course, no difference to the merchant whether the service is billed as advertising or lighting, nevertheless it is frequently much easier to get a merchant to spend liberally in advertising than in what he considers simply an ordinary operating expense, to be kept at the lowest point. There are no successful merchants nowadays who do not believe in advertising in one form or another, and to talk electric advertising is likely to excite more interest than to talk an increase in operating expenses.

NON-PEAK LOAD.

We publish elsewhere in this issue an article on the business developed by the central-station company at Marion, Ind., which conveys an interesting lesson on central-station economy and management. The principal lesson to be learned from Marion is the importance to a central-station company of taking a large part of its power business on "non-peak" contracts, whereby the power load is turned off during a short period covering the maximum winter lighting peak. Although much has been said for years about the importance to a central-station company of getting a load which will utilize the generating capacity during hours when it would otherwise be idle, we doubt whether many companies realize what a far-reaching effect a considerable amount of this non-peak business has on the economical operation of a plant and its ability to market its product at low rates. The non-peak clause in the power contracts and the low rates are dependent one on the other. The low rate could not be given without the non-peak clause, and the low rate, on the other hand, makes it possible to get a large amount of business under a non-peak contract which would not otherwise be available. The practical effect of the non-peak business in Marion is to make the ratio of operating expenses to gross earnings much lower than is usual in central stations of this size. In fact, the Marion property upsets nearly all established figures on central-station factors. From an average yearly load which is 25 per cent of the maximum (the common figure) to an average yearly load which is 43 per cent of the maximum (the Marion figure) is a tremendous stride. Few know what that means save the central-station men who have, after much effort, succeeded in bringing up the yearly load factor a scanty 2 or 3 per cent.

In connection with non-peak power contracts, the first question the central-station man asks is: How is it possible to enforce them and get consumers to shut down motors during the prohibited periods? With small consumers on a large system it is, of course, difficult to enforce any such contract. In the case of the larger consumers it is comparatively easy. As a matter of fact, it is often not necessary to enforce the clause except in case of repairs on station apparatus. If the station maintains the reserve capacity which every station should do, it will not be necessary to enforce strictly the non-peak contracts, except at such times as one of the units in a station is disabled, and the reserve capacity of the station is needed for carrying the regular peak load. However, the best plan is that worked out at Marion, where the regular hours of the factories dependent upon electric power are made such as to provide for shutting down during the peak-load period of the station. As a matter of fact, this usually makes but a few minutes' difference in the shutting-down time from what it would be if there were no non-peak contract. As regards hours during which non-peak motors are not allowed to run, there will naturally be a difference in large and small towns, for the peak comes earlier in large cities than it does in small ones. To counterbalance this, however, the factories and business houses usually close earlier in large cities.

Retail Lighting Contract in New York.

At the hearing before the Public Service Commission of the First District, New York, in the investigation of electric lighting and power contracts, Commissioner Milo R. Maltbie announced that all the companies had agreed upon a retail lighting contract. This contract was one which had been passed upon several weeks ago, and simply guaranteed the companies in their property rights on the premises of a consumer, and relieved them from liability in case of accidents. These contracts with retail consumers can be terminated on three days' notice from either party, and are made at the flat rate of 10 cents per kw hour. All of the companies in New York agreed upon the terms of this contract and it will be the official form. For temporary service a deposit plan was arranged.

In the case of the Richmond Light & Railroad Company, on Staten Island, there was a clause providing for a minimum charge, and also an agreement that the rate might be increased or decreased on 30 days' notice. In all of the contracts provision is made for a deposit where the line is carried more than 100 ft., and this deposit is refunded by rebating 50 per cent from the bills until wiped out. In the cases of the Queens Borough Gas & Electric Company and the New York & Queens Electric Light & Power Company, the rate charged was 12 cents instead of 10 cents. After agreement on the form of retail contract the hearing was adjourned until July 16.

Convention of the American Institute of Electrical Engineers.

One of the most successful of the annual conventions of the American Institute of Electrical Engineers is in session at Atlantic City as we go to press. Two meetings per day are scheduled for Monday, June 29, to Thursday, July 2, during which time 34 papers will be read and two addresses delivered. An outline of the papers was given in a former issue. The subjects treated proved of such general interest and the attractions of Atlantic City were so enticing that on the opening day more than 300 members and guests were in attendance. The entertainments provided by the committee in charge included a reception and dance, visits to piers, yachting, sailing and golfing, all of which were enjoyed by a large number of the members.

The session on Monday morning was opened by an address of welcome delivered by Mayor Franklin B. Stoy, of Atlantic City, who explained the advantages of the place for conventions by stating that although its real population is less than 50,000, more than 250,000 visitors can be accommodated. His offer of the freedom of the city to the A. I. E. E. was received with applause.

The address of President H. G. Stott, which he characterized as the "annual swan song," dealt with the evolution of engineering. He explained that engineers may be divided into two general classes: First, those who believe that the engineer should be restricted to a specific vocation; second, those who wish to see him take his place not only as an engineer, but also as a public-spirited citizen and leader. While the legitimate field of work of the engineer is extremely broad and almost unlimited, yet as a rule he has apparently decided to keep in the background and to come to the front only when called. The result of this policy is that when the opportunity comes, the engineer is taken at his own valuation and passed over for others who, while not suffering from modesty, are lacking in engineering education and experience, and therefore are forced to call on engineers (to act in a subordinate position) to supply the incumbent's deficiency in the qualifications necessary for the office. If the engineer wishes to progress and assume his proper place in the world, he must be aggressive. Engineering of to-day should be definable as the art of organizing and directing men and controlling the forces and materials of nature for the benefit of the human race.

President-elect L. A. Ferguson, upon being introduced by President Stott, expressed the hope that during the next year a special effort will be made to interest young engineers in the affairs of the Institute in order that they may obtain benefit from contact with older engineers of wide experience. Moreover, many of the members of sister engineering societies, such as the National Electric Light Association, should take a more active part in Institute matters, while members of the Institute should have more interest in the affairs of the association.

Below is given a summary account of the proceedings of Monday and of Tuesday morning. Abstracts of the papers presented and of their discussion will be printed in following issues.

The first papers presented at the meeting were by Mr. C. M. Goddard on "Electricity and Fire Protection," and by Prof. F. G. Baum on "Water Power Development." In the discussion of Mr. Goddard's paper, Prof. J. P. Jackson entered a plea for the co-operation of the A. I. E. E. and the underwriters, in order that the loss by fire, which represents an absolute loss to humanity, may be minimized and insurance rates may be lowered. The paper by Mr. Baum led to an animated discussion. Mr. J. H. Finney and Mr. J. P. Jackson criticized Prof. Baum for assuming water power to be a local rather than a national asset. The former considered that water-power rights should be subjected to government control, with charges that would encourage development by private capital while allowing the ownership to remain with the government. Mr. P. T. Wells explained the policy of the government with reference to water powers, which consists in issuing permits for 40 years at a specified charge on the cost of development. Mr. William McClellan pointed out that in discussing water-power rights, distinction should be made between water powers in their primitive state and those that have through partial development been spoiled for complete development. Dr. Steinmetz also criticized Professor Baum for assuming that water-power development is a local asset only, as utilization of water power would conserve the coal of the country, which is a matter of national importance; moreover, the whole country is interested in the preservation of the forests. He suggested a charge for water power based on the saleable value of the kw-year, the rate to be placed low enough to encourage capital to undertake development. The rights should have a limited term, but the property should not be confiscated by the end of that term.

On Monday afternoon the first paper of the program was that by Mr. W. Lee Campbell on "Automatic Telephone Systems." Written communications were read from Messrs. A. B. Smith and John Weeks, which discussed, respectively, the relation between the amounts of interconnecting apparatus required for trunking and manual automatic systems, and the relative advantage of party lines in manual systems and multiple sub-offices in automatic systems. Prof. Morgan Brooks stated that the decrease in the time consumed in making each connection in an automatic system in comparison with that of the manual system is advantageous, not only reducing the number of required trunk lines between stations, but in improving service by decreasing the length of the "busy" period, and thereby increasing the accessibility of each subscriber to the caller.

The next paper presented was that of Mr. R. A. Fessenden on "Wireless Signalling," which was abstracted by Dr. A. E. Kennelly in the absence of the author. There was no discussion. Dr. A. E. Kennelly then presented a paper by himself and Mr. S. E. Whiting on "The Variable Speed Stroboscopic Fork." Mr. J. B. Taylor said that one objection to the stroboscopic fork is that since it measures speed directly, it is not suitable for measuring differences between speeds, and hence cannot be used as a slip indicator for testing induction motors, but Prof. C. A. Perkins pointed out that this difficulty may be overcome to some extent. Dr. C. H. Sharp expressed his great appreciation for the excellent work done by Dr. Kennelly and Mr. Whiting in producing a convenient portable stroboscopic fork of wide range and almost universal applicability for accurate speed measurements. The next paper was that by Mr. Charles E. Waddel on "Electric Heating at Biltmore." In the discussion Mr. P. H. Thomas called attention to the necessity of using engineering methods when the heating of a house by

electricity is undertaken, as in this case cut-and-try methods are not applicable. The remaining discussion was conversational, in which the author answered questions.

(*By Telegraph.*)

At the opening of the session on Tuesday morning papers by Messrs E. E. F. Creighton, Austin Burt and P. H. Thomas were discussed together, the respective subjects being "Lightning Arresters," "Tests of Oscillations in Transformers" and "Lightning Phenomena." Dr. Steinmetz said that since many lightning phenomena are now well understood we soon shall know how to perfect control and how to eliminate disturbances. At present ample protection at the station is afforded by the electrolytic lightning arrester and on the line by over-head wires. He suggested the use of sodium tunstate to render tell-tale arrester papers fireproof. Mr. P. M. Lincoln considered that Mr. Thomas was incorrect in concluding that the over-head wire does not protect. Dr. Kennelly stated that it is well known that the top wires of telegraph circuits are less affected by lightning than bottom wires. Mr. J. B. Taylor stated that indications of tell-tale papers are indefinite if the conditions are not known. Mr. D. B. Rushmore considered that experience shows that the grounded wire does furnish protection from lightning, and Mr. J. W. Frazer stated that electrolytic arresters are satisfactory and reliable. Mr. W. L. Waters considered it to be impracticable to use condensers between turns on transformers and that it is better to use choke coils or extra insulation. Mr. W. McClellan also criticised drawing definite conclusions from tell-tale papers. Dr. Steinmetz stated that lightning may cause internal disturbances in a system 40 miles distant.

The next paper presented was that by Mr. J. W. Frazer on "Engineering Features of the Southern Power Company's System." The paper was discussed by Messrs. J. H. Finney, D. B. Rushmore and P. M. Lincoln in a complimentary manner. Mr. W. S. Lee explained that the object of using steam as a secondary power was to insure constant service to mills now owning steam plants.

The next paper on the program was by Mr. Austin Burt, entitled "Three-phase Power Factor." This was discussed by Messrs. Thomas, Adams, Bedell and Behrend, with reference to a proof offered by the two-wattmeter method of power measurement. The meeting was then adjourned until the evening.

Relation of Government Fuel Investigation to the Solution of the Smoke Problem.

Mr. D. T. Randall, engineer in charge of the tests at the United States Geological Survey fuel-testing plant, delivered an address before the annual convention of smoke inspectors, held in Cleveland, Ohio, June 24, on the relation of the government fuel investigation to the solution of the smoke problem. In it he stated that the possible benefits to the government and to the public resulting from the work entrusted to the fuel-testing division led the President to appoint a number of prominent engineers to act as an advisory board on fuel and structural materials investigations. The board meets occasionally to discuss the nature of the experiments which are most needed and in a general way the means of conducting them. The experimental work is done under the direction of the chief of the technologic branch, the details being settled after consultation with engineers who are experts in the particular lines being investigated.

The purposes of the fuel investigations now in progress at St. Louis, Mo., and at Norfolk, Va., are as follows: To lessen the waste in the nation's fuel supply; to determine the amount, quality, properties and most efficient methods of utilizing the fuels belonging to the United States, occupying some 50,000,000 acres; the analyzing and testing of coals, using carefully collected samples typical of the various coal fields in the United States, with a view to assembling of data which will serve as a basis of information needed both for the purposes of the government and those of the general public; to determine means whereby low-grade fuels, bone coal, culm, slack, washery refuse, lignites and peats, heretofore practically unused, may be made of commercial value; and the abatement of smoke, with the resulting increased efficiency when burning coal, with all kinds of equipment.

The importance of making investigations to secure economy can be better appreciated when it is considered that the cost of fuel delivered to the furnaces, including all items such as the cost at mines, freight, cartage, handling and firing at the plant, on locomotives, steamships, etc., has been placed at nearly $2,000,000,000 annually for all the coal used in this country. A saving of 1 per cent on the entire fuel bill of the country would amount to nearly $20,000,000 annually.

A study of the fuel values of coals burned while conducting some 540 boiler tests has shown that the value of the coal depends almost entirely on the number of heat units which it contains as determined by a calorimeter, these relative values being influenced somewhat by the amount and character of volatile matter and of ash present in the coal. This information has strengthened the position of the government engineers who desire to purchase coal on a specification which has for its basis of payment the B.t.u.'s and ash in the coal. For the coming year a very large part of the coal purchased for the government will be paid for according to its value as determined in the government chemical laboratories. One of the largest purchases under this form of contract is for use on the Isthmus of Panama and calls for the delivery of 400,000 tons this year.

Investigations of the washing and coking tests of coals have also shown the possibilities of utilizing poorer grades of coal than are commonly employed, and point to a very considerable saving in the fuel supply. The experiments on the briquetting of coal have shown that the slack coal, which is otherwise difficult to utilize, may be made into artificial lumps and used with high efficiency in power plants or for locomotive use. A study of the furnace conditions in connection with the boiler tests show the influence of different methods of burning coal with relation to the reduction of smoke. These tests have demonstrated the possibility of burning certain kinds of coal efficiently without smoke in an ordinary furnace. They have pointed to possibilities of modifying furnaces so that practically all fuels may be burned without smoke under favorable conditions. Some bulletins have already been issued on this work, but those which deal directly with the smoke problem are now in course of preparation. The tests made at the producer-gas plant have shown that it is possible to burn almost any grade of coal with the very highest efficiency and absolutely without smoke. Bituminous coals having as high as 45 per cent of ash, lignites and peats, which are considered low grades of fuel for boiler furnaces, have been very successfully burned in the producer, generating gas for the development of power in a gas engine. The low-grade lignites of North Dakota developed as much power per pound in the gas producer as do the very best West Virginia bituminous coals, when utilized in a steam boiler with a simple non-condensing engine. The results of these investigations will have an important bearing on the question of smoke prevention.

Electrical Energy Generated in Chicago.

The controversy in Chicago on the subject of supply of electrical energy within the city limits from plants along the Sanitary Canal has brought out some interesting statistics. City Electrician William Carroll, in a report to the chairman of the Council committee on finance, gives the following table showing the "maximum electrical horse-power in the city of Chicago, May 26, 1908":

Companies.	Electrical horse power.
Commonwealth Edison Company	211,720
Elevated and surface street railways, exclusive of current furnished by Commonwealth Edison Company	93,532
Small electric light and power companies	13,041
Small isolated plants	79,275
City street lighting and isolated plants	7,000
Sanitary district	15,000

The same report estimates that the total water power that will

be available for development at Lockport on the Sanitary Canal will be 34,091 hp. Deducting losses of 22 per cent in the water-wheels, 5.5 per cent in step-up transformers, 8.4 per cent in step-down transformers, 10 per cent in distribution lines and feeders, and 9.8 per cent in customers' transformers, 18,671 hp remain for distribution.

Street Lighting in St. Louis.

Somewhat more than a year ago the Civic League of St. Louis appointed a committee to investigate and report upon the most desirable and economical system and method of lighting the streets and alleys of the city, and a report of this committee has just been published in pamphlet form. Among the members of the committee were Profs. A. S. Langsdorf and J. L. Van Ornum, of Washington University.

The report, which contains many illustrations having a bearing on street lighting, includes the history of street lighting in St. Louis, and a discussion in detail of the cost of street lighting as furnished by municipal plants in Chicago and Detroit, together with data as to public lighting costs in a number of other large cities in the country. A number of pages is devoted to descriptions and views of street fixtures used in various cities, and particularly of ornamental posts. The report contains a thorough discussion on the subject of private vs. municipal ownership and operation of lighting plants, and an estimate is given of the cost of construction and operation of a municipal lighting plant for St. Louis.

The present contract for St. Louis street lighting expires Aug. 31, 1910, and the committee recommends that definite arrangements for the lighting of the streets should be made in advance to secure the best system of lighting and the best terms in the city. It believes that, for the present at least, the residential section of the city should be lighted by gas and the business section by electricity. The opinion is expressed that the present cost of lighting of $97.50 per arc lamp per year, $19.65 per incandescent lamp, and $27 per mantle lamp, is unreasonably high and should be materially reduced. It considered it to be clear that the function of street lighting is non-competitive in character, which the municipal government itself must either undertake or carefully regulate and control. Such lighting cannot be secured at a minimum cost to the city by competition.

Three possible ways of securing reduction in the cost of electricity are considered, namely, by constructing a municipal plant, by encouraging competition, and by regulating and controlling prices. The conclusions of the committee concerning these several methods are given below:

A MUNICIPAL PLANT.

1. The total cost of operating a municipal plant, if operated in a business-like manner, would be approximately 2½ cents per kw-hour, or about $69 per arc lamp per year, and about $17 per incandescent lamp per year.

2. But the danger of partisan politics in the management and operation of the plant, which tends to reduce its efficiency and increase its cost, indicates the inadvisability of municipal ownership except as a last resort.

3. Municipal ownership in the place of public franchise grants merely transfers the danger of political mismanagement from the legislative body, which grants the franchise, to the administrative officials appointed to operate the plant.

4. The economy of municipal operation and control has not yet been proved in this country; only two of the first 10 cities, Chicago and Detroit, have attempted it. The experience of these two cities is not such as to warrant the statement that a municipal plant would be cheaper than contract lighting.

5. In the opinion of the committee the conditions at the present time are unfavorable for the construction and operation of a municipal electric-lighting plant for the lighting of the streets of the city; and it believes this function should not be undertaken by the municipality if reasonable rates and efficient service can be secured from private companies. However, the city should reserve the right to construct its own plant.

COMPETITION.

1. The duplication of investment and equipment, the damage to the pavement, and the injury to the appearance of the city, make competition wasteful, ultimately add to the price paid by the consumer, finally inducing public lighting companies to merge.

2. The company which supplies commercial lighting can supply public lighting at a minimum cost to the city, because (*a*) every increase in the demand for service means a decrease in the cost of production; (*b*) an electrical plant, primarily for street lighting, cannot be operated economically since its daily output is small and it is under full load for less than half the time. A commercial plant is under a more nearly uniform load during the 24 hours of the day; (*c*) a private company can take immediate advantage of inventions and improvements for reducing the cost of production. Municipal plants, as is shown by experience, seldom keep pace with modern methods.

3. Your committee is of the opinion that a resort to competition, while it might assist in reducing exorbitant rates temporarily, is only a makeshift; permanently satisfactory results and a minimum cost for lighting cannot be secured by competition.

REGULATION AND CONTROL OF EXISTING AND FUTURE COMPANIES.

1. The Enabling Act of 1907 gives the city full power and authority to fix and determine a reasonable rate both for gas and electricity, and to provide and enforce fines for the violation thereof.

2. A public utilities commission, composed of competent and trustworthy business and technical men, should be provided immediately by ordinance, with such powers as are prescribed by the enabling act.

Other conclusions of the committee are that payment for electricity and gas should be based upon metered service—the maximum cost per lamp per year being fixed by ordinance.

No contract should be made for gas or electric lighting covering a long period of years, and it should contain provisions for frequent readjustment of rates and a clause enabling the city, at intervals, to require the substitution of new and more efficient styles of lamps. Only in this way can the public reap the advantage of the rapid reduction being made in the cost of gas and electric light.

A uniform system of efficient and ornamental lighting should be established, especially for the business streets of the city. (*a*) In the business portion electroliers or arc lamps of uniform style should be adopted and so spaced as to brilliantly illuminate the streets by night and make them attractive by day. (*b*) In the residential portion it may be deemed advisable to supplement the present gas lights with arc lights at street intersections in order to secure adequate illumination.

In all of the conclusions reached, the committee was unanimously of the opinion that a definite and reasonable regulation and control of prices and service, determined by a public utilities commission, permanently established by ordinance under recent statute, is fundamentally essential.

Convention of National Electrical Contractors' Association.

The eighth annual convention of the National Electrical Contractors' Association of the United States will be held at the Auditorium Hotel, Chicago, Ill., July 15, 16 and 17. Much interest is being manifested in this. It is expected the attendance will be the largest on record. Contractors from every State in the Union will be present and a large sprinkling of guests, consisting of contractors' wives and people interested in supplying material to the electrical contracting trade.

The morning sessions on the 15th and 16th will be open ones for general discussion and talks on matters of interest will be given by prominent architects and engineers. The afternoon sessions of the 15th and 16th will be closed ones for members only.

Included in the entertainment features are a banquet on the

15th and an all-day outing on the steamship *Theodore Roosevelt* on the 17th.

The local committee on arrangements is composed of Arthur Frantzen, Ernest Freeman, Henry Newgard, Warren Orne and C. R. Kreider. Anyone desiring details can secure them by addressing C. R. Kreider, chairman of the local committee, 1808 Fisher Building, Chicago, Ill.

Cleaning Tungsten Lamps and Reflectors.

Electric-lighting companies and users of tungsten lamp installations may be interested in some directions recently prepared by an illuminating engineer for the cleaning, care and maintenance of an installation of tungsten lamps in prismatic bowl reflectors in a large store:

It has been shown that in a large city where soft coal is used, incandescent lamps and Holophane reflectors similar to those used in the lighting of this store will lose from 10 to 35 per cent in efficiency within a period of six weeks by the accumulation of dust and dirt on the lamps and reflectors. The average loss in that period is probably between 20 and 25 per cent. It is, therefore, a paying proposition for any store to establish a regular system of cleaning for lamps and reflectors, not only in order to have the glassware present a clean, brilliant appearance, but to secure proper illuminating results for the money expended in electrical energy.

As the tungsten lamp filament is very fragile and becomes more brittle with age, a special system of cleaning is necessary, and the following procedure was recommended: The lamp cleaner, for ordinary routine cleaning, should provide himself with a pail of strong soapsuds and water, a small scrubbing brush 4 in. or 5 in. long with stiff bristles, such as is used for cleaning vegetables in the kitchen, and several rags for washing and wiping. To provide against breakage, the lamps and reflectors should be cleaned while the lamps are burning, as the filaments are then soft and plastic instead of being brittle as they are when the lamps are cold. The cleaner should first turn on the lamp which he is to clean. It would also be well for him to be provided with a pair of dark glasses, as continued working with lighted tungsten lamps is likely to result in injury to the eyes. He should first carefully wash the lamp bulb and the inside of the reflector with a rag wrung fairly dry, and this should be followed with wiping. The cleaning of the outside of the reflector can be done either with a dry or damp brush, brushing lengthwise of the prisms or creases. Ordinary wiping with a cloth will do no good on prismatic reflectors because the cloth will not get to the bottom of the prisms. It will not be necessary to take the time to wipe the outside of the reflector dry. This cleaning should take place about once a month.

A stock of four or five extra reflectors, thoroughly cleaned by scrubbing in a pail of soap and water, should be kept on hand in the storeroom, along with the extra lamps. Whenever a tungsten lamp burns out a clean reflector should be placed on the fixture at the same time that the lamp is renewed, and the reflector formerly on the fixture taken down, thoroughly cleaned and placed in the storeroom. In this way each reflector will receive thorough cleaning when the lamp is renewed and there will be no necessity of running the risk of breakage of lamps by taking lamps and reflectors off of the fixtures before the lamp is burned out.

Convention of Association of Iron and Steel Electrical Engineers.

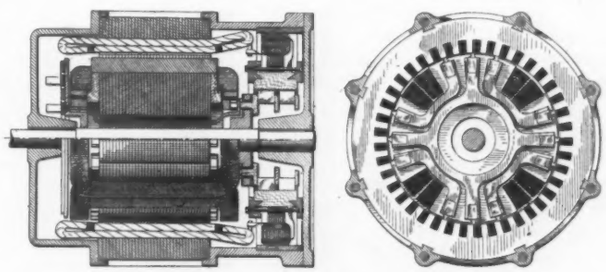
The first annual convention of the Association of Iron and Steel Electrical Engineers was held in Philadelphia, Pa., June 24, 25 and 26. The sessions were held behind closed doors in the Engineering Club so that the substance of papers and discussions is not available for publication. The program was as follows: "Report on Operation of Stoeckel Induction Drive," by Mr. G. H. Winslow; "Electric Drilling and Reaming," by Mr. F. W. Stevens; "Electric Motors for Heavy Torque and Rapid Reversal," by Mr. G. H. Richardson; "The Induction Drive," by Mr. A. P. Stoeckel; "Electric Motor Drives," by Mr. E. W. Yearsley. Wednesday's session was open only to members and closed with the propounding of questions and the relation of experiences. Thursday's session was open to members and representatives from the large electric manufacturing companies building apparatus for steel-mill work, and the latter presented papers bearing on various phases of steel-mill operation by electricity. On Friday excursions were made to the following plants: American Bridge Company, Pencoyd; Electric Storage Battery Company, Tioga, and New York Ship Building Company, Camden, N. J.

An effort is being made by the association toward standardizing mill motors. It was for that reason that manufacturers were particularly invited. At first motors were not installed in steel mills because the designers of the motors were not conversant with the conditions, and hence the electric drive suffered in comparison with other methods. As conditions became better understood, mill-type motors were brought out to meet them, and the result is that different manufacturers at present build motors with different sizes of shafts, key-ways, lengths of shafts, etc., so that it was impossible to substitute one make of motor for another in case of emergency. The aim of the association is to draw up broad and general specifications covering motor construction which shall be specific, however, as to the allowable temperature rise, number of parts, ease of repairing and size of gear and pinion and shaft.

The association at present is composed of 33 members, who are either electrical engineers or electrical superintendents in large steel-making establishments; no others are eligible. The officers are as follows: President, Mr. James Farrington; vice-presidents, Messrs. J. C. Reed and G. M. Sturgess; secretary, Mr. G. H. Winslow; treasurer, Mr. E. W. Yearsley. The annual meeting of the association will be held Oct. 14.

Single-Phase Commutator Motor with Stationary Armature.

On June 23 a patent was issued to Mr. S. S. Seyfert for a single-phase commutator motor having a revolving-field structure and a stationary armature. The arrangement proposed is illustrated in Figs. 1 and 2. The rotor member is provided with magnetizing field windings and windings for neutralizing the magnetomotive force of the armature windings. The current is led to the field winding by way of slip-rings, and thence



FIGS. 1 AND 2.—SINGLE-PHASE MOTOR WITH STATIONARY ARMATURE.

to the armature by means of revolving brushes bearing upon the internal surface of a stationary annular commutator.

The object in making the armature structure external and the field-structure internal is to obtain the most economical proportions for the active material; a compensated single-phase series motor giving the best performance when the effective number of armature turns is much greater than the number of field turns. It is stated that with an external armature, the ratio of armature m.m.f. to field circuit m.m.f. may be increased to almost any desired amount, because the armature is unrestricted in its dimensions; that is, the slots can be made of any desired depth without thinning the teeth—the teeth, in fact, become thicker with the greater depth of slot.

Application of Long Acre Company.

The New York Public Service Commission, First District, has denied the application of the Long Acre Electric Light & Power Company for approval of the issue of $10,000,000 of preferred stock and the execution of a mortgage to secure an issue of $50,000,000 of 6 per cent 50-year bonds, of which $12,000,000 bonds were to be issued at the present time. The decision was written by Commissioner M. R. Maltbie, whose recommendations were approved by the commission. The principal points of the decision are contained in the following extracts:

"The applicant urged that the Long Acre company intended to introduce a lamp of much higher efficiency than the carbon-filament lamp now in general use. Upon inquiry it developed that the proposed lamp is not yet in commercial use and has not become available outside of the laboratory. Indeed, there is still a question whether it will ever be so perfected as to be generally acceptable. But as the Long Acre company admits that it does not intend to supply these lamps free, that it does not own or control the patent, and that it has no rights which any other company might not secure, it would be perfectly possible for the present companies to put the same lamp into use. The existence of such a lamp and the possibility that the Long Acre company might use it do not, in my opinion, constitute a strong argument. This commission has power to compel the existing companies to provide any lamp of higher efficiency than those in use, which is a more effective means than mere competition. The companies have recently agreed to supply the most efficient lamps now upon the market.

"The Long Acre company says it may use a more efficient lamp than the carbon-filament lamp. This commission has power to compel the present companies to do so, and they have already agreed to supply the most efficient types commercially available. The Long Acre company says it intends to supply current at 8 cents per kw-hour without lamps. This commission has power to order a reduction of rates subject only to the provision that they may not be made confiscatory, and no company can supply current at a lower rate for any considerable period. If 8 cents will allow a fair profit, this commission can fix an 8-cent rate for the present companies upon the filing of a complaint in proper form. This commission also has power to order improvements in the manufacture and distribution of electricity and in the plant and equipment, to regulate the methods of supply and to have general supervision of all electrical corporations. If there is anything advantageous to the consumer which the competition of the Long Acre company will even temporarily produce that cannot be brought about by this commission under the public service commissions law, the company has not called attention to it. Further, if experience should develop any weaknesses in the law whereby the companies escape doing what the commission considers proper, it is believed that the Legislature will confer still other powers.

"It is doubtful whether this commission has authority to approve an issue of securities part of which is to be issued to replace bonds of questionable legality which were originally issued in payment for a franchise.

"The whole electric history of New York City points the futility of competition. In the early years of the industry numerous companies were organized. From time to time they were absorbed, only to be followed by new companies frequently encouraged by the city with the idea that competition was the life of trade and that the more competition there was the better would be conditions. But the same procedure occurred again and again. The new companies were merged or swallowed up, until at the present time there are but two electric supply companies operating in Manhattan, and these two companies, although nominally independent, are owned and controlled by the Consolidated Gas Company.

"The history of New York City has been duplicated in nearly every large city in the United States and in most of those in Europe, until at the present time there are few cities where there is genuine competition or where a customer who is dissatisfied with the service or the rates of one company may discontinue the service of that company and connect with another. It is coming to be generally recognized that monopoly control of electric light, heat and power may be very beneficial to the public if one company or the few non-competing companies can be placed under such public regulation and control as will secure for the public a fair share in the many benefits arising from unified management. That competition cannot be depended upon to protect the consumer from high prices and poor service has been fully demonstrated.

"The existence of competing companies necessitates constant opening of the streets to provide service connections to the houses and street mains for the distributing wires. To provide and maintain these additional services and mains means more frequent opening of the streets, more injury to pavements and ultimately more expense to the taxpayers—conditions which the public has been urging should be removed or reduced and not increased.

"Competition also involves duplication of generating plants and substations. Each company must provide sufficient plant not merely to supply the peak of the load, but to meet any accident which may occur. Machinery must at all times be held in reserve, and when there are several independent companies, no one of which may take a momentary advantage of the reserve of the other, they all must maintain reserves very much in excess of what one company must keep where it may fall back upon any and all of its stations to meet a failure at one of them. Again, it is well known that one company can generate current for the whole of Manhattan much more cheaply than can several companies, each one of which undertakes to supply the entire borough. Further, the loss due to distribution is larger where there are several systems.

"The result of such duplication of capital and the less economical methods of production and distribution is that the cost of delivering current to the consumer is larger under competition than under efficient monopoly.

"The company asserts that it should be allowed a fair return upon its property as it stands notwithstanding the fact that some of it may be unnecessary, for the public permitted competition and duplication of plants, perhaps even invited them; hence the company should not be punished for the mistakes of the public. In my opinion, the rates for electric current would be lower in Manhattan to-day than they are if it were not for the fact that the two companies are overloaded with an inheritance from the period of competition.

"In conclusion I recommend that the application be denied for the following reasons:

"First—No certificate to begin construction has been obtained from this commission or its predecessor, the Commission of Gas and Electricity.

"Second—It is probable that the bonds already issued are illegal as there is a grave doubt of the legality of the stock, neither issue having been approved by the Commission of Gas and Electricity.

"Third—It is doubtful whether the title of the Long Acre company to the franchise which it claims is perfect.

"Fourth—If the bonds already issued are illegal, the approval of the application would authorize the capitalization of a franchise, which is contrary to law.

"Fifth—The amount of bonds of the new issue is very much too large as compared with the amount of voting stock.

"Sixth—The construction contract does not adequately protect the interests of the Long Acre company or of the public.

"Seventh—The applicant has not proved that the existing companies are not properly conserving the public interest and convenience and that it would be to the advantage of the community to have a new company authorized to enter the field.

"Eighth—If a competing company were allowed to begin operations it is not likely that it would continue to operate independently for any considerable period.

"Ninth—Competition would cause inconvenience and expense to the public, would cause duplication of plant, would lead to waste and ultimately be urged as a reason why rates should not be reduced to consumers.

"Tenth—Practically all of the advantages claimed by the applicant as the probable results of competition can be secured through the powers of this commission, and until it has been demonstrated that these are ineffective it would be unwise to adopt a method which has proved to be ineffective in the past."

Hearing on the Proposed Accounting System for New York Electrical Corporations.

A hearing on the proposed accounting system for electric-lighting corporations was held on June 24 by the Public Service Commissions of the First and Second Districts, New York, at the offices of the commission of the first district, New York City. Mr. Frank W. Stevens, chairman of the commission of the second district, presided. The system under consideration was that prepared by the two commissions after the receipt of criticisms on the tentative classifications issued originally.

The meeting was called by the commissions of the two districts to inquire, in the language of the call:

"(1) Whether the system of uniform accounts for electric corporations jointly prepared by the bureaus of statistics and accounts of the Public Service Commissions for the First and Second districts under date of June 5, 1908, shall be adopted and made effective on Jan. 1, 1909, for all electrical corporations whose gross revenues from electric operations equal or exceed $500,000 per annum; and

"(2) Whether such system of accounts shall be prescribed for, and put into force on Jan. 1, 1909, by electric corporations whose gross revenues from electric operations aggregate less than $500,000 a year, with the proviso that such corporations may if desired combine certain of the operating expense accounts in Schedule B in the manner indicated;

"(3) Whether the fiscal year covered by the annual reports of electrical corporations to the commission shall be changed so as to coincide with the calendar year; and

"(4) Whether, in the event of such change in the fiscal year, the corporations concerned will accept for the current calendar year a form of report based on the aforesaid system of uniform accounts.

"It is expected that this will be the final hearing in connection with the matter of a uniform system of accounts for electrical corporations, and all such corporations desiring to be heard in this connection should be represented at such hearing."

Mr. Stevens said that the commissions recognized that the system under consideration is utterly impracticable for small companies. The plan, however, was to start with an amplified classification for large corporations and work down from that point to a system that would be satisfactory for small companies. That the amplified classification would be impracticable for small properties had been held in mind by the commission from the inception of the scheme.

Mr. W. Paxton Little, treasurer of the Niagara Falls Power Company, the largest power and lighting corporation in the second district, said that he did not receive the circular outlining the proposed system until June 19, and that sufficient time for its consideration before the date of the hearing was not allowed. The company, therefore, objected to the system and suggested that the old form of report be used for the six months ended June 30, 1908, and for the calendar year 1908, any change to be effective for the calendar year 1909. Mr. Little said that the company did not have a great deal of time to answer the first circular outlining a tentative classification, but did answer it, and that now little time was allowed to answer the revised scheme. He had specific objections to raise, but had not been given time enough to prepare replies.

Mr. T. N. Summers, representing the Ithaca Electric Light & Power Company, the Palmyra Gas & Electric Company and the Norwich Gas & Electric Company, spoke of the difficulties which would confront small companies in introducing an accounting system that provided for much detail, and asked if the proposed system for companies with small revenue would be submitted to them before it was adopted. He would like to have the members of the commission visit some small plants in order to realize the conditions under which such properties are operated.

Chairman Stevens said he believed it would be better for some companies if they would increase their accounting forces and know better than at present what they are doing.

Mr. M. R. Maltbie, commissioner of the first district, said that possibly some misapprehension had arisen from the fact that in the discussion so far the elaborate system had been given pre-eminence. To start with a large number of primary accounts and to group and reduce them for small companies would produce a system that would be adaptable for all classes.

Mr. H. M. Edwards, auditor of the New York Edison Company, said that the classification is an admirable definition of the principles underlying accounting. He was pleased to state that the representations of the committees representing the companies have been given due weight in the preparation of the system, and that many of the features of the first tentative classification to which objections were raised have been eliminated. Most of the objections advanced on behalf of the smaller companies were that the system was too elaborate. Such companies did not have the plants, money, employees or knowledge on the part of their working forces, necessary in the installation of such a system. Because of the lack of definite information regarding the system to be prescribed for small companies, Mr. Edwards said that the representatives of the properties were at a disadvantage; if the abbreviated system had been submitted further progress could have been made.

Mr. Edwards said he did not know whether it would be possible to sell all capital securities at par, but that any agreement into which the accounting officers might enter should not deal with principles of that character. It would not make much difference from an accounting standpoint where the discount on securities that had to be sold for less than par was charged. He would like to reserve any rights the companies might have respecting that feature of the system. In a uniform system the number of accounts must necessarily be compressed. The New York Edison Company had accounts that other companies would not need. Schemes of accounting had developed around personalities, and any attempt to secure uniformity must be based on a condensed system.

A number of detailed criticisms were made by Mr. Edwards. He criticised the text of the balance sheet accounts, "Furnaces and Boilers (Electric)," because it provides that the foundations and settings of such boilers and appurtenances shall be charged to that account. As a matter of fact, Mr. Edwards said that the foundations are part of the building and are assessed as such.

Chairman Stevens said that the electrical engineer of the commission had preferred to treat the foundations as part of the furnace cost.

Mr. Edwards replied that he would be glad to file an opinion with the commission on that subject; and that the foundations are always let with the building.

Chairman Stevens said that he knew of many cases where exactly the opposite practice prevailed.

Resuming his criticisms, Mr. Edwards said that the text for the capital account, "General Office Equipment," covered elevators, which are considered part of the building and taxed as such. He also criticised the capital accounts, "Coupon Special Deposits" and "Dividend Special Deposits," as unnecessary refinements. The purpose of these accounts is to show these disbursements as special payments to the payor in either instance and not to the holder of bonds or stock. Mr. Edwards thought that if the company had sent a check to a trustee under a mortgage for payment of bond interest it had paid the interest to all intents and purposes. While he would agree from a theoretical standpoint with the introduction of these accounts, he thought them unnecessary from a practical standpoint.

The capital account, "Unvouchered Items," was criticised by Mr. Edwards. Mr. W. J. Meyers, statistician for the commission of the second district, said that the idea in this account was that the liabilities should not be understated. Mr. Edwards

responded that there is always a floating asset which is more than sufficient to offset any floating liability. Theoretically, the introduction of this account was sound; but, practically, its value was questionable. The New York Edison Company keeps a memorandum record of such items.

In the income account provision is made for two accounts, "Electric Jobbing Revenues" and "Profit on Sales of Electric Appliances." Mr. Edwards thought that the former account should be made uniform with the latter by providing that the profit only from jobbing, not the total revenue, should be credited. The revenue would include the cost of labor, on which a company should not be taxed, as it would be if the total revenue from this source should be credited to income.

Mr. Edwards thought that uncollectible electric bills should be part of the operating expenses. The company had borne the expense of earning the sum, but the collection department had not been fortunate enough to collect the money. In order to show the unit cost of operation, these items should be treated through the operating, instead of the income, accounts. Uncollectible bills amounted, roughly, he said, to one-half of 1 per cent of the gross revenue.

Donations, Mr. Edwards thought, should be treated as operating expenses instead of deductions from income. Beyond these and several other points suggested, Mr. Edwards, as representative of the New York Edison Company, was satisfied with the operating accounts; but as a representative of the National Electric Light Association he would like to see a condensed system adopted. An official of a company operating in a town of 1000 or 1200 people could not keep the records required by an elaborate system. The scheme of capital accounts was elaborate and made no provision for small companies. Accounts were provided for original construction, additions, betterments and new construction.

Mr. Edwards declared that the National Electric Light Association classification was practically hopeless so far as small companies are concerned.

At the request of Chairman Stevens, the representatives of the companies expressed their preferences in regard to the date for the fiscal year which will be adopted by the commissions. All the companies favored the calendar year.

Mr. W. W. Freeman, vice-president of the Edison Electric Illuminating Company, of Brooklyn, said he would like to oppose the idea that the system is acceptable to the large companies. He said that there is a tendency on the part of those who study a system of this kind to view it from the accounting standpoint. The lack of funds might handicap some companies in reporting the details required, and the system would impose unnecessary hardships.

Mr. W. F. Wells, general superintendent of the Edison Electric Illuminating Company, of Brooklyn, speaking from the standpoint of an operating official, showed the difficulty of complying with the requirements of the system.

Chairman Stevens said that there was no way to escape the necessity for the use of judgment by individuals; a man would have to learn the principles of accounting, and conform to them with good sense and fairness. The struggle is to combine the practical and theoretical so far as possible. The instructions of the commission of the second district to its statistician were to prepare as nearly as possible a theoretically perfect system and then work down the number of accounts.

Mr. Wells suggested the consolidation of accounts in various instances.

Mr. F. L. Dame, engineer of the Electric Securities Company, which controls the Geneva-Seneca Electric Company, said that it seemed to him the intent of the law was that the companies should be able to raise capital, but he did not think they would find it possible to sell securities with this classification. He wanted to make an additional plea for small companies that had little profit and found difficulty in doing business even on higher rates than the large companies secure.

Mr. S. R. Bradley, Jr., vice-president of the Rockland Light & Power Company, of Nyack, N. Y., said he believed an ideal system was possible, but only if it was extremely simple. If a system is to be adopted and applied uniformly, the number of primary accounts should be very small and subdivision should be permitted by individual companies. He wished to protest against the adoption of the proposed system.

The commissioners asked those present at the hearing for opinions as to where the next division of companies having gross revenue of less than $500,000 should be made. In reply to this request, it has been suggested that companies be divided into five classes—A, B, C, D and E—class A being companies with less than $25,000 gross revenue; class B, companies with $25,000 to $100,000 gross revenue; class C, companies with $100,000 to $250,000 gross revenue; class D, companies with $250,000 to $500,000 gross revenue, and class E, companies with gross revenue of over $500,000.

Statistics showing the revenues of companies in the State, taken from the report of the Commission of Gas and Electricity for the year ending June 30, 1906, were submitted after the close of the hearing by Mr. C. H. B. Chapin, secretary of the Empire State Gas & Electric Association. Of the 122 electric companies which reported to the commission for that year, 67, or 55 per cent, had a gross revenue of less than $10,000; 106, or 87 per cent, had a gross revenue of less than $50,000. In addition to the 122 companies reporting there were 77 that did not report and 33 municipal plants. Of the latter, 110 companies and municipalities, approximately 100 would be in the class with gross revenue of less than $10,000, or taking the 232 electric companies and municipalities as a basis the figures would be 167, or 72 per cent, with a gross revenue of less than $10,000 each, and 206, or 88 per cent, with a gross revenue of less than $250,000 each. Cases were cited showing the work done by the employees of a company with gross revenue of $150,000 and a company with gross revenue of $12,000. These examples were given to show the difficulty which would be encountered by the companies in dividing the operating expenses into a large number of accounts.

A letter addressed to the commission of the second district by Mr. Chapin as secretary of the Empire State Association states:

"In defense of the suggestion that the point of division below $500,000 gross revenue be set at $250,000 instead of $100,000 gross revenue, I beg to submit statistics in regard to the working force of a very well run company having a gross revenue of approximately $150,000, which, I think, will show the very great difficulty which would be encountered in dividing the expenses among as many accounts as are given in the classification submitted.

"The working force and the statistics of what each man does are as follows:

"1. General manager. Supervises the operation of the entire company generally, does considerable personal soliciting for new business, and devotes considerable time to advertising and settling any complaints of the customers.

"2. Auditor. Acts also as cashier and head bookkeeper.

"3. Bookkeeper (man). Acts also as collector.

"4. Clerk (girl). Bill clerk, report clerk, and clerk at desk for collections.

"5. Clerk (girl). General bookkeeping and also general stenographer for all departments.

"6. Canvasser and solicitor.

"7. Solicitor. Has also general charge of advertising, does commercial engineering work and settles complaints.

"8. Nernst lamp department. One man has charge of all Nernst lamps, care, repairs and installation; also reads meters three or four days a month and takes his turn every third or fourth night as trouble man.

"9 and 10. Meter tester and helper. They set and remove all meters, and make all tests and adjustments; read meters three or four days a month; test motors on request of customers, and each takes a turn every third or fourth night as night trouble man. The helper also takes the Sunday dog-watch at the station once every two weeks.

"11, 12 and 13. Arc lamp department. Three men. One man makes all repairs to street and commercial arcs; reads meters

three or four days a month; sometimes helps in trimming the street and commercial arcs; does all wiring or switchboard work in the station, also inspects a certain number of consumers' motors each day and sees that they are kept in good working condition. One trimmer, whose duty it is to trim all street arc lamps. One patrolman, who patrols the circuit each night, changes the street incandescents, helps the trimmer occasionally, reads meters three or four days a month.

"14. Janitor. Takes general care of offices; washes and cleans all globes for street arcs and street incandescent lamps when brought in; also trims all commercial arcs and does all storeroom work.

"15, 16 and 17. Distribution department. One foreman and two linemen do all outside work, installing and removing transformers, installing, connecting and repairing all services and installing street arcs and incandescents. They also make all repairs to arc, incandescent and line poles, which, however, in this particular case are all the same.

"18, 19, 20, 21 and 22. Station force. One chief engineer, two engineers and two switchboard operators. The chief engineer, in addition to superintending station operation, does also all electric and steam repairing to small parts.

"23, 24, 25, 26, 27 and 28. Boiler room force. One foreman, two firemen and three coal passers.

"Of the entire force of 28 employees the wages of all but 9 or 10 must be divided between from two to six different accounts according to the junior classification. Take for example, the case of the meter helper whose wages probably amount to $12 or $15 a week. This amount would have to be divided among six different accounts, and to determine accurately how much should be charged to each account would be practically impossible. The same difficulty obtains with respect to the janitor, whose wages amount to $8; this amount would have to be divided among general expenses, municipal street arc operation, municipal street incandescent operation and commercial arc operation.

"The following statistics of the operation of a small electric company with gross revenue of approximately $12,000 and supplying current to two separate villages will show the need of still further subdivision and a simpler system of accounts for companies of this size. The current is generated by water power for the greater part of the year, but there is a reserve steam plant which has to be operated for two or three months. The station force consists of one foreman, one night man and one day man, and in case it is necessary to run the steam plant, extra help is engaged. The plant is located in one of the villages supplied and a transmission line is run to the other village. In each of the villages there is one general utility man who does practically all the work, including canvassing, meter reading, collecting, installation work, repair work, care of street lighting system, etc. In the main office there is one bookkeeper and the general manager, who divide all of the office work and considerable of the outside work between them. The entire force consists of seven employees, and to divide their time between a large number of accounts with any degree of accuracy would require expert figuring, which could not be done with the present force."

Convention of Railway Telegraph Superintendents.

The Association of Railway Telegraph Superintendents held its annual convention at Montreal on June 24, 25 and 26, and this convention was particularly noted for the attention given to the problems connected with the adoption of the telephone for train dispatching in connection with railway operation.

The first session was opened on Wednesday morning by President E. P. Griffith, who introduced Alderman Sadler, representing the Mayor of Montreal, with a brief speech of welcome to the city. On behalf of the business men, the delegates were welcomed by Mr. L. Chaput, vice-president of the Business Men's League of Montreal.

The first paper presented at the meeting was that of W. W. Ryder, of Chicago, superintendent of telegraph of the Chicago, Burlington & Quincy Road.

DISPATCHING TRAINS BY TELEPHONE.

In his paper Mr. W. W. Ryder referred to the extensive use by electric interurban railways of the telephone for the dispatching of trains. It is now recognized as the standard method of operation, he said. On steam railways it is only recently that the use of the telephone for this purpose has been attempted on a sufficiently large scale to secure a fair demonstration of its possibilities. The immediate incentive for these experiments was the near approach of the date for the enforcement of the federal eight-hour law, coupled with the scarcity of telegraphers.

He then described the experiments on his road. The railroad company has strung two 210-lb. copper wires for the telephone service and has made the installation as complete as possible. At the present price of copper this circuit cost approximately $100 per mile and the station equipment about $50 per station. This is more expensive than a telegraph circuit, and the maintenance cost is a little higher, but the results have proved so satisfactory that the additional expense is regarded as fully warranted.

In handling orders by telephone the same general methods are observed as with the telegraph, any figures or names of stations and proper names being spelled out letter by letter. The telephone service is much quicker and more flexible than the telegraph, and enables the despatcher to keep in closer touch with the trains. The telephone works better in bad weather than in good—which is the reverse of the telegraph. In wet and foggy weather this is a matter of great importance.

The improvement in the handling of train dispatching by telephone has been so clearly demonstrated that the company has decided to attempt to handle other messages in like manner, and in a short time all business for the way offices on certain portions of its line (both main and branches) will be handled by telephone, this to include Western Union business as well. At junction points where branch telegraph lines are to be worked and at certain wire test offices, it may be necessary to maintain telegraph service, but at all other points all classes of business will be handled by telephone.

During the discussion that followed, Mr. S. L. Van Akin, Jr., of Syracuse, N. Y., assistant superintendent of telegraph, New York Central Lines, gave the results of some of his experiments with the telephone in dispatching.

Mr. Ryder, in referring to the growth of the use of the telephone, spoke of the rapid strides it has made during the last six months. While the New York Central started its experiments on the main line a little earlier than six months ago, within that period roads which have started to use the telephone for train dispatching and the mileage covered by this service, in operation or authorized, are as follows:

ROADS USING TELEPHONE FOR TRAIN DISPATCHING AND MILEAGE COVERED BY THIS SERVICE, EITHER IN ACTUAL OPERATION OR AUTHORIZED.

	Mileage.
Illinois Central	2,536
Chicago, Burlington & Quincy	746
Chicago & Northwestern	478
Chicago, Rock Island & Pacific	333
Michigan Central	259
Chicago, Milwaukee & St. Paul	223
Great Northern	202
Northern Pacific	109
Baltimore & Ohio	105
New York Central	95
Lake Shore & Michigan Southern	88
Delaware, Lackawanna & Western	62
Wheeling & Lake Erie	60
Canadian Pacific	49
*Pennsylvania Railroad, lines east	225
*Lake Erie, Alliance & Wheeling	104
Total miles operated by telephone	5,674

At the second day's session Mr. Joseph P. Church, of Decatur, read a paper by Mr. G. C. Kinsman, superintendent of the Wabash Road, on the subject of "Commercial Reports."

A paper by Mr. O. C. Greene and read by Secretary Drew

*Branch lines operated by bridged bells and hand generator signaling.

at Thursday morning's session gave some suggestions for "Reducing Telegraphing by Printed Forms." Mr. Greene advocated the use of a blank form where there are any considerable numbers of routine reports of similar character to be transmitted by telegraph. The use of such forms materially reduces the amount of telegraphing. But care must be taken to avoid a multiplicity of blanks and overdoing the matter. In the discussion of this paper Mr. Ryder spoke of the desirability of considering the adoption of new standard code letters, on the substitution of the telephone for the telegraph in train dispatching.

When President Griffith exhibited a telegraph dispatch dated 1851 as one of the early messages, Mr. Selden brought out a laugh by his remark: "Is there any explanation how this delay in transmission occurred?" Another old message was from London bearing the date 1848.

Mr. J. L. Davis read Mr. U. J. Fry's paper on "Dry Batteries." An abstract of this paper will be presented in a later issue.

A special type of key used in connection with dry-battery circuits was exhibited by Mr. Davis. Mr. Ghegan explained its working and showed how operating the circuit closed throws the battery out so that it will not run down, but leaves the line closed to receive signals.

A paper on the results of recent legislation by Mr. E. A. Chenery, of St. Louis, was listened to with the greatest attention, and was later discussed by the members in executive session.

At the Thursday afternoon session Mr. W. F. Williams, of Portsmouth, Va., read a paper on the history of the association, in which he expressed the warm appreciation for the work which has been so ably carried on by Mr. Drew during his many years of service as secretary.

During this session Mr. Griffith announced the election of 25 new active members and 16 associate members, more than three times the number of men who met for the first convention in the Grand Pacific Hotel, in Chicago, in 1882.

Mr. C. S. Rhodes, of Indianapolis, read a very interesting paper on qualifying operators for train dispatching, which brought out a great deal of practical discussion of methods of examining for promotion, following up work to see that routine is adhered to, etc.

Detroit was selected as the place for next year's convention, June 23, 24 and 25. The election of officers resulted in the choice of Mr. W. J. Camp, president; Mr. G. W. Dailey, vice-president, and Mr. P. W. Drew was unanimously re-elected secretary.

Mr. Davis read a paper by Mr. J. H. Jacoby on "Depot Wiring from the Contractor's Standpoint" which gave many useful suggestions. (An abstract of this paper appears on another page.) Mr. Selden, in the discussion of this paper, urged that greater care be given to securing safe conditions and neat appearance with respect to entering wires of electric light and telephone companies. Mr. Camp, Mr. Selden and Mr. Taylor joined in the discussion on this topic.

Mr. Selden described a plan used for wiring underneath the floors of the B. & O. offices at Baltimore. The whole floor is gridironed with wire channels having outlets at the walls. As the channels are made of steel, it is a very easy matter to locate one exactly, either by measurement, or, as a check, by use of a telephone and battery. One pole of the battery is connected to the channel at the wall and one terminal with the receiver wired in series connected to a "feeler." The approach of this feeler to the vicinity of the steel channel causes a distinct click to be heard.

The third day's session was opened with a paper by Mr. William Maver, Jr., on "Wireless Telephony," tracing in concise form the development of this art up to the present time.

The final subject for discussion, which aroused a great deal of interest, was the question of determining a standard for high-tension and other wire crossings over railroads. A committee was appointed to consider this matter thoroughly.

CURRENT NEWS AND NOTES.

COST OF NEW YORK CITY PUBLIC SERVICE COMMISSION.—According to a statement issued by the Public Service Commission of New York City, its expenses for the year 1908 will be $1,095,000, in addition to $150,000 appropriated for its use out of the State Treasury, making the total cost $1,245,000.

DEVELOPMENT IN DENVER.—The last annual report of the Denver Gas & Electric Company shows that it has practically 36,000 customers, some using gas only, some using electricity only, and some both. The population is about 150,000. The percentage of operating expenses for the year, including both gas and electricity, was 58 per cent after deducting "new-business" expenses.

STREET RAILWAY CONVENTION.—It has been decided to hold the annual convention of the American Street & Interurban Railway Association and its allied bodies at Atlantic City, N. J., on Oct. 12, 13, 14, 15 and 16. The exhibit of apparatus will be made on Young's Million Dollar Pier. The alternative choice of convention city was Denver, and a careful study of the situation was made before deciding not to go so far west.

ENGINEERS' CLUB OF ST. LOUIS.—The thirteenth anual bulletin of the Engineers' Club of St. Louis reports a total membership of 272. The club is a member of the Association of Engineering Societies, which now includes 18 societies. The present officers of the Engineers' Club are: President, Mr. W. G. Brenneke; vice-president, Mr. E. E. Wall; secretary and librarian, Prof. A. S. Langsdorf, and treas., Mr. O. F. Harting.

NEW HAVEN RAILROAD ELECTRIC LIGHTING INTERESTS.—When the New York, New Haven & Hartford Railroad secured control of the Connecticut Railway & Lighting Company, it was stated to be the intention to dispose of the electric lighting and gas plants forming part of the property, retaining only the trolley interests. It is now stated, however, that the returns from the lighting properties have been so favorable that these properties will be retained.

IRRIGATION WITH ELECTRICALLY-DRIVEN PUMPS.—The author of the article on this subject appearing in the first issue of June advises us that because of an error made in recopying the manuscript, the cost of an electrically-driven pumping plant with wooden pipe distributing system was stated to vary from $12 to $500 per acre. The cost should have been given as $12 per acre and the increased value of production resulting from irrigation $200 to $500 per acre.

WIRELESS FRAUD SUPPRESSED.—The Postoffice Department has issued a fraud order against the Oakland Transcontinental Aerial Telephone & Power Company, of Oakland, Cal., which has been advertising that it owns an invention whereby it is possible to talk around the world without wires or cables. It was found that the circulars and advertisements used in selling stock were copied word for word from a booklet issued by a reputable company for the purpose of placing on the market a device for limited wireless telephoning.

NEW TELEGRAPH CODES.—The International Telegraph Conference, recently in session at Lisbon, appointed a Board of Control to censor telegraph codes. The board consists of one member each from England, France and Germany. Codes in use will not be interfered with, although each government reserves the right it has always had of any word offered. Code makers are advised by Hon. Chas. P. Bryan, American Minister to Lisbon, who was a member of the conference, to offer their codes promptly to the Board of Control for censorship. If the codes are approved, a certificate will be issued which will enable customers to be assured that every word in the code must be accepted, no matter in what country it may be offered.

Illumination of the Singer Building Tower.

THE Singer and Bourne Buildings are steel-frame office structures 14 stories high occupying a plot at the corner of Liberty Street and Broadway, New York City. Both are owned by the Singer Company, and they virtually form a single structure covering a site of 24,000 sq. ft. in one of the most congested districts in the world. At the fourteenth story there rises above the roof of the Singer extension a large tower with the highest point of the roof 612 ft. above the curb. This tower, which at present is the tallest structure built for commercial occupation, and next to the Eiffel Tower, is said to be the tallest in existence, has nominally 40 stories above the surface of the street, although in reality there are 42 accessible floors, including a mezzanine floor devoted to storage and mechanical apparatus. The dimensions of the tower justify it in being considered as a regular office building rather than a tower, except that the great height gives it an appearance of slenderness which is comparative rather than actual.

The tower is rectangular in plan, with faces 63 ft. long, one of which is parallel with the Broadway building line and about 30 ft. back from it. Wide bay windows projecting 3 ft. beyond each of the exterior walls of the tower are treated as architectural features and enlarge the floor area to 3737 sq. ft., thus providing for a number of large rooms devoted to commercial purposes on each side of the elevator shaft, which occupies the center of the tower. Great care has been taken in the architectural treatment of the tower to make it harmonious with the building and to secure the greatest beauty and impressiveness combined with dignity. The faces of the shaft are relieved by the bay windows forming tall, vertical panels and are diversified by the location of small windows. At the fifteenth and sixteenth stories there are projecting belt courses, which form a comparatively narrow horizontal panel. Similar courses at the twenty-first and twenty-second, twenty-seventh and twenty-eighth stories form other panels. At the thirty-fourth floor an ornate trompe or terra-cotta balcony projects from each face of the tower and is supported on consoles extending to the thirty-third floor, where the bay windows terminate with arched heads. The balconies are segments of a circle 40 ft. in diameter intersected by the faces of the tower.

Above the thirty-sixth floor the tower is surmounted by a circular dome, 63 ft. in diameter at the base and 28 ft. at the crown; it is 50 ft. high and contains four floors. The base is

FIG. 1.—TOWER OF SINGER BUILDING AT NIGHT.

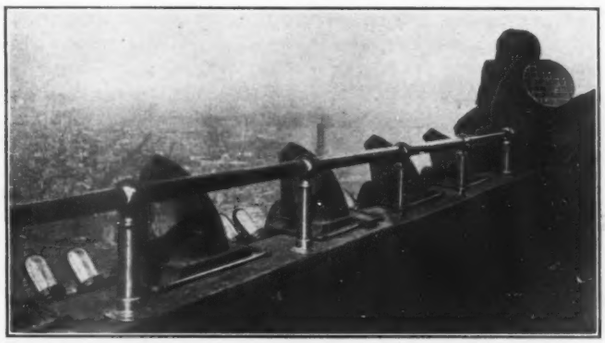


FIG. 2.—ARRANGEMENT OF LAMPS ON BALCONY AT FORTIETH FLOOR.

FIG. 3.—SEARCHLIGHTS TEMPORARILY INSTALLED ON ROOF.

embellished with exterior arches and ornamental bull's-eye, and the crown at the fortieth floor is enclosed by a massive cheneau. On the top of the dome is an ornamental lantern 16 ft. square at the base and 60 ft. high. Its cross-section changes from rectangular to octagonal and terminates in a circular colonnade surmounted by a small dome with a flag pole rising from it to a height of 652 ft. above the curb. The dome roof is 550 ft.

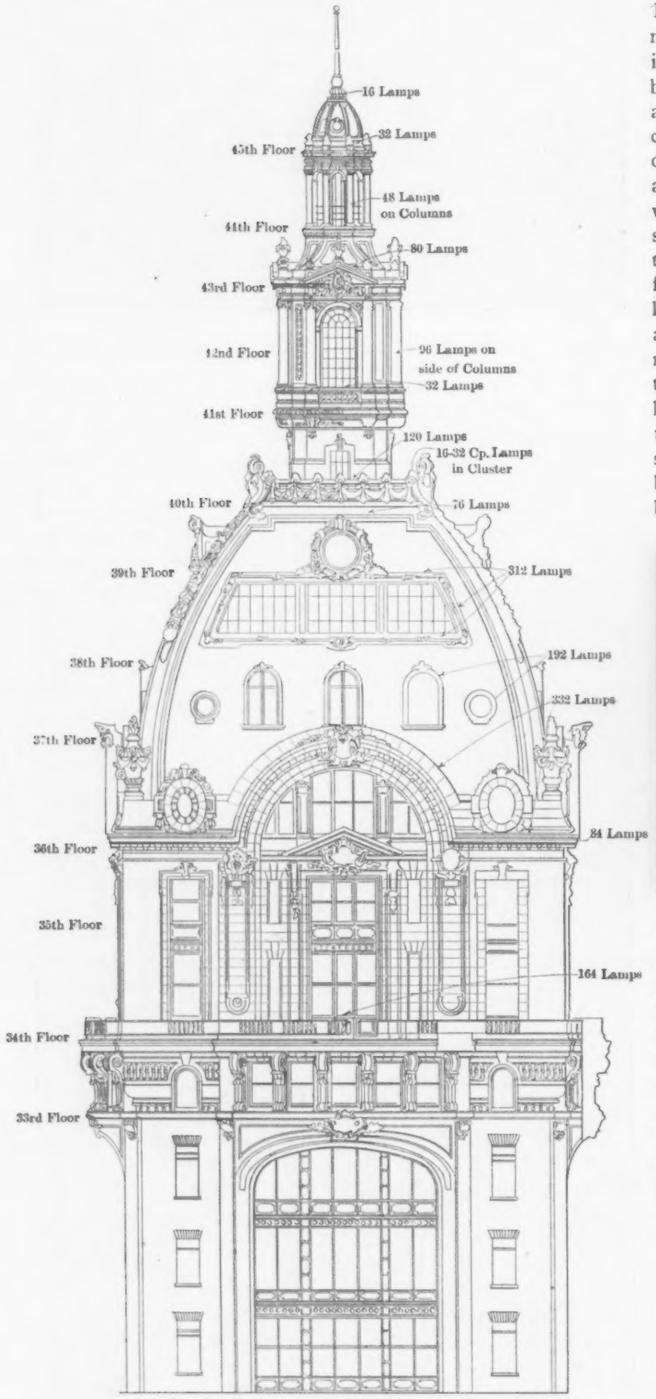


FIG. 4.—PARTIAL ELEVATION OF SINGER TOWER, SHOWING LOCATION OF LAMPS.

above the curb and a balcony in the lantern, 564 ft. above the curb, is the highest point in the tower accessible to the public. The photograph showing the lamps as they appear when looking down from the tower was taken from an opening immediately below the flag pole, 604 ft. above the curb. The highest office floor is at the thirty-eighth story, being at an elevation of 524 ft. The balcony, shown in Fig. 4, herewith, is on the fortieth floor. The elevator running to this floor has a clear lift of 547 ft. This elevator is of the electric-traction type.

The tower is illuminated by a system entirely different from any heretofore used. Usually towers are illuminated by a system of outline lighting, the lamps being visible. In the illumination of the Singer tower no lamps are visible and the aim has been to bring out the architectural features in prominent relief. The tower lighting system combines searchlights located on the main roof which have their rays directed upon the tower, and incandescent lamps on the top of the tower concealed from view by the structure, and by reflectors. Over 25 special searchlights are located around the base of the tower just back of the cheneau or cresting on the Broadway and Liberty Street sides of the Singer Building, and equally distant from the northern and western sides of the tower. The lamps are trained so as to wash the sides of the tower with light, and shutters are provided so as to cut off sharply on the outline of the tower showing the tower brightly against a dark background. From the thirty-fourth story to the top, the tower is illuminated by incandescent lamps. The reflectors are adjusted to throw the light upward and thus to continue the illumination on the curved portions not reached by the searchlights at the base of the tower. Around the main balcony rail on the thirty-fourth floor 164 lamps are located. On the top of the pediment over each window on the thirty-sixth floor 84 lamps are arranged. Between the thirty-sixth and thirty-seventh floor 332 lamps are arranged on the large central arch, the two bull's-eyes and the flat attic coping between them. Between the thirty-seventh and thirty-eighth

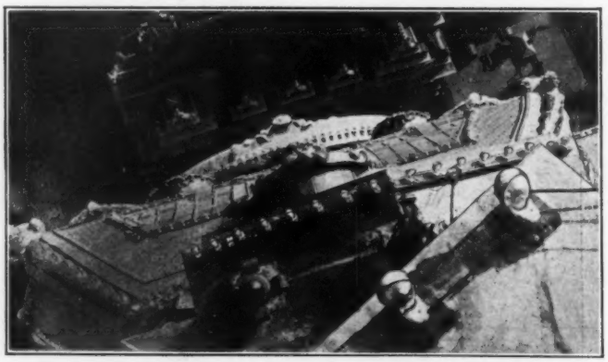


FIG. 5.—VIEW FROM HIGHEST POINT OF BUILDING, SHOWING LAMPS.

floors 192 lamps are fitted to the top of the large windows and on the top of each of the bull's-eye windows. There are 312 lamps arranged around the large windows extending from the thirty-eighth to the thirty-ninth floor, and 76 lamps around the bull's-eye windows at the fortieth floor. Around the balcony on this floor are arranged in watertight sockets 120 lamps, and there are 16 lamps of 32 cp placed in clusters behind the cartouches, as shown in Fig. 4. In the lantern 32 lamps are placed on the balustrade of the balcony, and there are 96 lamps located on the sides of the columns in vertical rows. On top of the gables and attic at the forty-third floor 80 lamps are distributed and the lamps above this point are distributed as follows: 48 on the columns extending from the forty-fourth to the forty-fifth floor; 32 lamps arranged on the faces of the cornices, and 16 lamps in the crown at the base of the flag pole. There are thus 1600 incandescent lamps in all used to illuminate the tower above the thirty-fourth floor. In addition it is the intention of arranging a searchlight to play upon the flag floating from the pole at the top of the building.

The effect at night is very pleasing indeed, and the illustration shown in Fig. 1 does scant justice to it. The tower has not the spectre-like appearance shown in the engraving, the red color of the brick and the brownish tint of the copper dome being preserved. From a distance it looks as if the tower reflected the light from a large fire in the vicinity. All of the architectural features are preserved and are distinguishable. The tower is visible at night from great distances; it can be seen

from the Orange Mountains in New Jersey and from Jamaica, on Long Island. The illumination was planned by Mr. C. G. Armstrong, the consulting engineer for the owners, and by Mr. O. F. Semsch, engineer for Mr. E. Flagg, the architect of the building. The M. B. Foster Electric Company was the electrical contractor.

Electric Light and Power at New London, Conn.

BY WILLIAM H. STUART.

New London, Conn., at the mouth of the Thames River and Long Island Sound, is a typical New England city. Its population of some 20,000 inhabitants is greatly augmented by an influx of summer visitors each year. New London has a cottage colony second only to Newport. The city has considerable municipal pride, which is easily noted in the attractive conditions of the streets, public buildings and shops, in which electric lighting plays no small part. New London has manufacturing interests of quite some importance in its silk and quilt mills, machine-tool shops and ship yards. The ship building and repairing dates back to old colonial times when New London's position as a flourishing port first brought wealth to its citizens.

The first electric-light plant was started in 1886 by a manufacturing firm known as the Oneco Manufacturing Company, the object being to offer something in competition with gas. This small plant was operated for some time in lighting the streets of the city by an agreement with the City Council, and also supplied a little commercial lighting. In 1897 the plant was bought by the New London Gas Light Company, and a consolidation was effected, the new concern being called the New London Gas & Electric Company, which title has been retained to this day. The equipment in 1897 consisted of a small arc machine and engine. As the business grew additional machinery was installed until the plant has grown into one of considerable size.

The equipment consists at present of four water-tube boilers aggregating 1700 hp; a 1000-kw Curtis turbine; a 540-kw generator direct connected to a vertical cross-compound Ball & Wood engine of 900 hp; three 150-kw generators connected by a shaft operated by a Ball & Wood 500-hp horizontal engine and a 250-hp McIntosh & Seymour engine. The switchboard comprises five generator panels, four line panels, five arc-light panels, one extra panel and one meter panel. The ashes are removed by carts and are used for filling, but in the near future some new means will have to be devised to get rid of them, the most likely method being to employ a scow and dump them at sea. The coal is brought in barges and transferred from the wharf to coal bins. The boilers are all hand fired. The company has had a big task before it in transforming an old, antiquated building designed for other purposes into a modern plant.

The street mains are all overhead. The transformers are set on poles, and with the exception of those on State, Main and Bank Streets, which are grouped, they are all used individually. The arc circuits are tested out every day. The commercial incandescent circuits have ground detectors. The force required to operate the station consists of a chief engineer, three engineers and three helpers, four firemen and two coal passers. The work is divided up among three shifts. In the construction department there are five linemen, one troubleman and one trimmer. The company uses an Orient auto-wagon at night for the troubleman and for various other purposes. In the daytime it is used by the meter department. This was one of the first autos used in central-station work and easily did the work of two similar wagons drawn by horses and costs very much less. Mr. A. J. Campbell, the general manager, in commenting upon its work said that it was very serviceable, especially in the summer time, on account of the large extent of territory covered by the lighting system.

The meter department is situated in the basement of the office, where a large space is set aside as a stock room, repair and test room. The meters upon receipt from the makers are thoroughly tested and a record placed in the company's files. The meter is given a number and is then placed in stock. The meter department force is composed of two men, one for general repairs and testing, and one for installation. All meters are subjected to a regular systematic test throughout each year it is in service. The meters, on complaint of excessive bills, are tested in circuit, a portable testing set being employed.

Meter routes are made up on printed index slips of different colors, those for gas being printed on white paper and the electric ones on a buff-colored paper. The slips are arranged in route order and given to the indexer, who is employed at the office. After an index book has been completed it is turned over to the bookkeepers, who sort the different slips into folio order and place the indices in the ledgers.

The town is divided into three sections. Bills for those residing in the first section are delivered on the first of the month and discount is allowed to and including the tenth. Bills for the second section are delivered on the eleventh and discount allowed to and including the twentieth. Bills for the third section are delivered on the twenty-first and discount allowed to the end of the month.

Two men are used in reading meters. The bookkeeping is done by one set of bookkeepers for both gas and electric service. No collectors are employed; the office of the company being centrally located is within easy reach of the great majority of the consumers, and it was found that after the consumers had once become accustomed to coming to the office the relations between the company and the consumer became better. Delinquent notices are not sent out, but a list made of all delinquent accounts at the end of each month and a shut-off man sent out. The company in the past found that the same set of consumers allowed their accounts to run, and when notices were sent out these received little attention. In the handling of complaints each one is given careful attention.

In the new-business side the New London Gas Company has made great advances. In the beginning of active work to obtain new business a great many schemes and methods which had been a success in other cities were gone over thoroughly and carefully. One of the so-called "circus campaign" methods of the Western towns was given a trial, but it accomplished nothing. The "follow-up letter" circular and mail advertising campaign was given a good trial, but it failed. Finally, Mr. Campbell decided that for best results all unusual and sensational methods would have to be eliminated and a straight canvassing and advertising campaign, consistently and persistently followed up, was adopted. A solid and substantial basis was finally found in the word "Educate," which meant that both employees and the public had to be shown and taught the varied uses of electricity. With the aid of papers and meetings relating to the electrical and commercial side, the employees were educated to a better understanding of the plans and policy of the company, of the performance of their own duties, and of the possibilities of electricity. This method finally brought to bear a united force acting to educate the public.

The new-business department consists of a sales agent and two solicitors, and last summer a lady demonstrator and solicitor for household electrical appliances was employed with very satisfactory results. The work of the lady demonstrator was a particular feature of the company's new-business campaign. A young lady was finally engaged who was well known in the community, and she began her work by dropping in on friends and inviting them to join with six or seven others at an electrical tea to be given at the office. This tea was very neatly and nicely arranged in a space curtained off in the office, so as to insure the utmost privacy. The ladies came and enjoyed themselves, were shown in actual operation the electrical flatiron, the curling iron, heating pads, the small cooking stoves, sewing machines driven by a motor, clothes-washing apparatus run by a motor, and all the other appliances of the household that are used daily. This awakened their interest in electrical appliances, and after a very enjoyable social hour they left with the invitation to come again at any time. Different groups of ladies were regularly invited to the electrical teas until at last the teas became quite the thing in New London. The lady demonstrator

by this means was able to gain an entrance to a great many homes which would have been impossible to reach in any other way. If on an unexpected visit she found that the lady of the house was not at home, she left a card, and after learning of the time which the lady would be at home in the near future, would make it a point to call then. It was found also that the flatiron could be used as the entering wedge for the electric light and where the light was already installed for other appliances.

A regular canvass was also made by the two solicitors in the business portion of the town, and by consistent work a great many consumers were gained. For a show-room a large space is allotted in the office so situated that consumers paying bills and, in fact, anybody having business with the company, passes through it. The room in which the teas were held, and which is especially devoted to electric appliances, is in the rear of the show room, and has a space about 15 ft. sq. curtained off as a reception room. This is fitted up with every electric appliance that is practicable, which are shown at any and all times. If inquiry is made in regard to some new or old electrical appliances not on exhibition the company will, if it is possible, obtain a sample and place it ready for operation on the consumer's property; if after a fair trial dissatisfaction is shown, the appliance is returned and with the exception of current charge the consumer pays nothing.

At one side of the show room is a small room divided into three small booths by means of heavy curtains, keeping out all outside light. In each of these booths are adjustable gas and electric fixtures by means of which various globes and reflectors may be compared and the effect shown of a greater or less distance from a given plane, thus illustrating the effect of high or low ceilings and the effect of lengthening or shortening chandeliers. In one of the booths a set of different colored curtains on rollers have been set up, arranged so that any curtain can be pulled down to cover the wall. A fair-sized white piece of cardboard is placed on a small stand at such a point that it is illuminated only by the light that is reflected from the curtain. By using the different colored curtains it is easy to demonstrate to customers the effect which the color of the ceiling and walls and hangings of a room have upon the general illumination obtained. This dark room is daily proving of more and more assistance in giving consumers a clearer idea of the subject of illumination, its possibilities and limitations. A fairly good-sized advertisement is run in one of the three local papers each week.

The power business has been on the increase, and at present there are 760 hp of alternating-current motors connected. These are 220-volt motors, excepting in the three largest installations, where 550-volt motors are used. The largest size motor is 50 hp, of which there are three connected. One of these operates the compressor in one of the best equipped stone yards in New England. A motor also operates the most complete electric hoist ever constructed, which is fitted with a 22-hp, 550-volt motor. This yard, with its complete electrical equipment, is one of the show places of New London.

The rates for incandescent service are 15 cents per kw-hour, with discounts of from 5 per cent to 25 per cent according to the quantity used. The municipal rate for series-incandescent lamps is $19.50 per lamp per year. There are 278 series-incandescent lamps of 25 cp in New London. The multiple-arc service for commercial consumers is charged at the incandescent rate of 15 cents per kw-hour, subject to the same discounts. The municipal arcs, numbering 191, are charged at the rate of $86 per lamp per year. The power rate is 10 cents per kw-hour, with a very liberal discount. The greatest number of power users are supplied with current at from 5 cents to 8 cents per kw-hour. In sign and window lighting a flat rate is given which varies with the number of lamps and the hours of burning. The consumer buys the sign and the company furnishes the lamps and takes care of the sign, turning it off at a stated hour.

The officers of the company are: President, Mr. Walter Learned; vice-president, Mr. B. P. Learned; secretary and Manager, Mr. Alex. J. Campbell; treasurer, Mr. M. T. Warner.

Alternating-Current Motors and Lamps for Industrial Plants.

By Warren H. Miller,

Electrical Engineer Standard Oil Refineries.

In all large industrial plants the alternating-current system has unquestionably become the preferred installation for both lamps and motors. Many of the modern large railroad shops in the country are thus equipped, and the same is true of many of the great industrial plants. This result is attributable principally to the reliability of the induction motor and the flexibility of the alternating-current transmission system. For constant speeds, the induction motor is the embodiment of simplicity. It has a heavy starting torque, good efficiency, no brushes or other wearing parts beyond its two ring-oiled bearings, has nothing moving on it to become grounded or short-circuited.

The variable-speed type of induction motor used for cranes, bending-rolls and such tools for intermittent service is in effect the plain induction motor with provision for inserting resistance in the secondary rotor circuit, which itself is wound for somewhat higher resistance than that of the simple induction motor. It has three collector rings with brushes, but this addition by no means makes it as complicated and liable to short-circuits as is the commutator of the equivalent direct-current motor. The controller and rheostat are about the same in both the alternating-current and direct-current machines and either type will accelerate crane speeds with all needful celerity. Both of them are at a disadvantage in requiring a "street car" controller which is and always will be more or less of a nuisance. The splendid starting arrangements of the constant-speed induction motor have been so well devised that in the near future the demand for an oil-immersed controller for variable-speed motors will cause it to become the standard equipment.

Glancing for a moment at the lighting possibilities with alternating current, both 110-volt and 220-volt carbon incandescent lamps give very good service in shop practice. There seems to be a certain prejudice against the 220-volt lamp in the East because of its long filament, which is considered an element of weakness. If the filament is properly anchored, as in the "mill type" lamp, there is no trouble at all from broken filaments and the 220-volt lamp will withstand over-voltage far better than the 110-volt lamp. The lamp will withstand momentary fluctuations to as high as 300 volts without burning out. The writer has used them freely with good results, and in the West they are the standard alternating-current lamp for railroad shops. They are used at a frequency of 60 cycles, but the "flicker" of those on 25 cycles is so purely a matter of the imagination that on actual test it is impossible to decide which of two lamps is using direct current and which 25-cycle alternating current.

As regards the arc lamps, the 110-volt enclosed lamp when used on 60-cycle circuits gives very little trouble, requiring overhauling about once in six months in addition to the regular carbon renewals. It consumes from 4.5 to 5.5 amp as compared with from 6 to 7 for the direct-current lamp. For interior lighting the writer prefers the tantalum or tungsten cluster to either type of arc lamp. Enclosed arc lamps must be spaced not over 40 ft. to give good shop service and then the light is "thin." The light from each lamp measures 300 mean hemispherical candle-power, which is precisely the light given by a cluster of six 50-cp tungsten lamps consuming one-half of the watts. Moreover, the latter has no maintenance charge, costs only one-third as much initially, and gives a yellow light with plenty of body and no sharp shadows.

The 220-volt, 60-cycle arc lamp is quite undesirable, giving a long blue arc, easily affected by line disturbances. It is better to use the 110-volt type with a small transformer attached to the lamp. This arrangement increases its cost by about $3 over the plain 110-volt arc lamp.

The 25-cycle arc lamp in both voltages has been a failure so far, but recent experiments with the flaming arcs on 25

cycle have demonstrated their entire steadiness mechanically and as to stability of flame, but the arc flickers perceptibly. For outdoor service the flicker should not be objectionable, and even reading by it is not difficult.

For the average industrial plant using alternating current the 60-cycle, three-phase installation is unquestionably the best for supplying energy for lamps and motors from the same buses. If the plant is large, covering from 200 to 800 acres, the best e.m.f. is 440 volts with transformers at the distributing stations for the lamps. If the plant is smaller than about 200 acres a 220-volt transmission system is the proper one. When one considers that the whole wire cost for several hundred horsepower of mixed lamp and motor load will not exceed $1,500, he will appreciate that it is hardly worth while to save a few hundred dollars by using 440 volts only to spend it all again in banks of transformers for the lamps. Assuming that two distributing centers will be used, there would be needed at least six transformers which at even $100 apiece would instantly use up the difference between the 440-volt and the 220-volt wire account. Moreover, in behalf of the latter can be urged the greater safety, simplicity of distribution, same cost of motors and far less trouble in maintenance of insulation.

In the large plant the prime movers may be either reciprocating steam engines, turbines or gas engines, preferably the latter, as its coal cost is about 40 per cent of that of steam unit and there is no great trouble in operating steadily and in paralleling either 60-cycle or 25-cycle generators driven by engines using producer gas. There is some surging manifest at the station board, but out in the works no effect whatever is noticeable. If hydrocarbons or high thermal gases, such as naphtha, are present the paralleling of 60-cycle generators is difficult owing to excessive back-firing; even with oil gas having 1250 B.t.u. per cubic foot, however, large gas-engine driven 25-cycle generators parallel successfully.

Unless there is little likelihood of overloading, it is hardly worth while putting a steam turbine in an industrial plant. True, there are hundreds of turbines running in the United States and giving absolutely no trouble, but for industrial work where all sorts of conditions and overloads are encountered the turbine is not well adapted. A good 300-kw marine-type compound reciprocating engine running at 270 r.p.m. will be only 3 ft. wider than an equivalent turbine and not so long; it is not affected by balancing troubles, has equal economy and can be repaired—any part of it—by the works machine shop and it will be back in the engine and running again in a short time. These small matters are mentioned merely to bring them to the attention of those who are in a tremendous hurry to see the funeral of the "old-fashioned" reciprocating engines.

If one selects gas engines, and steam is available, a good steam engine-driven exciter of ample size makes a very efficient steadier for gas-engine disturbances. Plants operated with motor-generator exciters often experience trouble from surging because of the exciter changes with the variations of the main voltage at the very time when it should be steady. In steam-driven plants, motor-generator exciters give no trouble, for the machines are not liable to be thrown out of step. In either case, the prime mover of the exciter should be a reciprocating engine with a good fly-wheel. Small turbines are not economical in steam consumption, but are also not steady enough for exciter work.

The writer believes in extending the mixed installations of lamps and motors on 60 cycles down to the smallest plants—even as low as two 50-kw units at the industrial plant generating station. Such a plant is much simpler and easier to operate than the equivalent direct-current equipment. The motors will be, for the most part, 220-volt, constant-speed machines, giving no trouble and the incandescent lamps will be in three circuits, one in each phase lead.

Using enclosed arc lamps outside and tungsten lamp clusters inside, the whole plant can be operated by one electrician having his headquarters at the generating station, but by no means confined to it, as the station requires extremely little attendance.

Assuming that an equivalent plant used 20 direct-current motors, at least two competent electricians would have to be employed, one of whom would have to visit each of the motors, examine and oil the commutator, blow off accumulated dust with compressed air, and adjust any sparking brushes. Such a plant using 40 motors aggregating 800 hp and using 400 amp in arc lamps and incandescent lamps under the writer's management, required three electricians constantly on duty attending to motors and lamps, and the repair bills and troubles from sparking commutators were a constant charge on the system.

These motors were in average industrial plant situations, running in the foundry, forge shop, wood-working department, structural steel shop and various machine shops. The trouble lay not alone in the constant care needed to keep everything in first-class shape, but in stormy weather, when grounds out on the transmission lines had to be taken care of, and also whenever there was much new construction going on, the regular motor inspection had to be skimped, with a consequent sparking of commutators. In every respect there was a great contrast to the smooth-running induction motor outfits installed later.

The three-phase, constant-speed induction motor consists of two simple parts—the stator, in the slots of which are laid the three sets of coils of the primary phases in regular rotation, and the rotor, consisting of heavy bars of copper secured into large copper rings at each end, the bars being laid in slots. The primary carries all of the current from the lines; that in the rotor secondary is produced by induction. The primary *can* be "grounded," particularly where the coils enter and leave the slots, if the motor is used in wet or acid-fuming places. The writer usually forestalls any such "grounds" by covering the stator coils solidly with tar before putting the motor into service.

In the matter of grounds the stationary primary is on the same plane with the field coils of direct-current motor, but there all resemblance ceases. Unlike the armature of the direct-current motor, the moving secondary of the induction motor is the most indestructible piece of electrical machinery yet devised. It is impossible to short-circuit it—the bars are already short-circuited in the end rings; it cannot be burned out by any possible induced current; the heavy copper bars are practically immune from moisture, gases or acid fumes; there are no commutators, nor brushes, nor any moving electrical parts whatever; there is merely the shaft, which runs in ring-oiled bearings holding a month's supply of oil.

The rotor is invariably provided with some form of fan blades to blow air upon the coils on the stator. The frame of the motor is so designed as to catch these air currents and deflect them down upon the iron core of the stator, thus keeping it constantly cool. This is *not* such an unmitigated blessing as might be imagined. The air surrounding the motor often contains foundry dust, or cement dust, acid vapors, or fine wood dust. In these cases the writer invariably resorts to the old scheme of plugging up all the inlet openings except one on each side from which a 2-in. pipe leads to fresh air. The motor will suck air from a source 10 ft. or more away. In either a wood shop, a foundry or a forge shop the simplest thing to do is to run a length of 1-in. pipe, tapped to the nearest blower line. This arrangement is much better than the totally enclosed "dust-proof" direct-current motor. The latter encloses too much—dust, sparks and heat—and one never knows how bad things are until the covers are unscrewed. It is best never to close the outlet openings of an induction motor in any case. The current of air through them is always outward, no matter what the location of the inlet holes. As to the success of this scheme, the writer has used 12 motors thus equipped in a chemical works where if a rope is left out over night it will be corroded and unsafe by the following morning, and yet the motors have run without a stop for four months on full rated load and are only perceptibly warm. They replaced steam engines that have run all the year, 24 hours a day for 20 years, only stopping to renew belts and bearings.

Another service in which the constant-speed induction motor excels is for shop elevators. These elevators are usually belt-driven; works managers do not have to be reminded of the

endless controller troubles encountered when they are electrically driven. The elevators are usually operated by a husky cupola-tender or stock-wrangler, whose idea of managing a controller is to lay violent hands on it and reach to the full-speed notch without worrying over the intermediate ones, or else he will hover over each notch so long that the coils get hot and become brittle. To circumvent these propensities with an induction motor it is well to use a heavy fly-wheel for load equalizer. In this way any peak or sudden rush of current is avoided, and if the lamps are in use they will not be affected by the elevator. The writer has used three 2-ton elevators operated in this manner by 7½-hp motors.. Their fly-wheels have been known to carry the whole load up to the top of the run, fuses having blown in the motor when the elevator was about half way up. The drop in the voltage on the lamps is not noticeable even though the day-load generator is only a 50-kw machine.

Induction motors are started by another exceedingly durable and fool-proof device—the auto-transformer. This device is simply an oil-immersed, single-coil transformer with taps taken off at intervals on the coil. A choice of five starting voltages from 30 per cent to 80 per cent of full-line e.m.f. is given by these taps. They lead to a drum controller immersed in transformer oil, the whole apparatus being enclosed in a cast-iron case. This device is dust-proof, waterproof and arc-proof; it will not wear out, burn out or rust. Wire rheostats can also be used in starting induction motors, but the writer feels that they are undesirable.

The auto-starter cannot be used as a speed controller. The rotor always attempts to reach synchronous speed, and if the motor is left on a low-voltage tap of the auto-transformer the rotor will follow this tendency. At the same time it will be drawing heavy current from the starter so that the windings will soon get as hot as if overloaded at normal voltage to the same current.

The manufacturing companies invariably ship the starters connected on a low-voltage tap, so that they will not start a line of shaft driving tools or any heavy load of big inertia. The remedy is very simple because the connections can be altered to the tap of next higher voltage in 15 minutes. In starting a motor from rest it is well to take plenty of time at each notch. There are only two and there is no necessity for hurrying from point to point as in the direct-current starter. The rotor should be allowed to come nearly to full speed with the controller on the second notch and then the handle should be thrown to running position. The line current in starting varies from 1¼ to 1¾ normal full-load value at the two taps.

The usual wiring diagram shows six fuses—three for starting and three for normal running currents, which latter are switched in at running position of the controller handle. As this arrangement makes awkward fuse boxes in conduit work, the three "running" fuses are usually omitted. The electrician should be careful not to get the starting and running leads crossed in connecting to the controller. If any two leads of a three-phase induction motor are crossed, the motor will reverse its direction of rotation, so that it is possible for a motor to start a load in the right direction and violently to reverse the direction of rotation when the controller is thrown to the running position.

In measuring the starting current (or, if the motor is to have an ammeter permanently connected in one lead) the instrument should be inserted on the line side of the starter. If placed between the starter and the motor, the ammeter will show in starting, not the line current, but the much greater current delivered to the motor by the auto-transformer.

The combination of a starting device in a cast-iron box with heavy cast-iron handle, and a motor with no brushes, no groundable moving parts and mill-shafting oil boxes, forms the most durable and sure-to-run equipment yet put on the market for electric drive.

The variable-speed motor has a considerably heavier frame than the constant-speed machine, a coil-wound (not squirrel-cage) rotor and requires a larger diameter than the constant-speed motor of the same rating. Moreover, it costs about 50 per cent more.

The speed is controlled by varying a resistance inserted in the revolving secondary through collector rings. The resistor is either a cast-iron grid or an iron-wire device wound on an incombustible core. These rheostatic devices always give more or less trouble. There are many first-class and efficient mechanical means of changing speed, and most machine tools are equipped with them, so that the writer considers it undesirable to introduce electrical controlling devices which always prove unsatisfactory.

For cranes and such tools the variable-speed motor is a necessity, and no trouble is experienced in obtaining the proper motors even to operate 120-ton locomotive-carrying cranes. At present the alternating-current cranes constitute only about 2 per cent of the total, mainly because the machine-shop world has been slow to appreciate the good points of the induction motor on account of prejudice and misinformation. The writer has personally operated alternating-current cranes in foundry service and frequently installed them in all classes of work The foundry crane, which has been in service for two years, has caused absolutely no trouble whatever. It can do the most delicate foundry lifting with ease, picks up 50 per cent overload; only six controller fingers have been replaced in two years—a record just about three times as good as the corresponding direct-current crane would make. About the only point that can be successfully urged in favor of the direct-current crane is that the series motor will make greater speed with light loads, while the speed of the induction motor is limited to the synchronous value. Opposite to this can be placed the time spent by the electrician in caring for three commutators, removing dust and filings and turning down at least one commutator per year, also controller troubles due to the heavy, persistent arc of the direct current. The synchronous speeds of 60-cycle induction motors are 1200, 720, 600 and 480 r.p.m. Any one of these speeds may be got in a motor of almost any rating, but 1200 and 720 are standard for high and low speeds in all ratings from 5 to 75 hp. In 25-cycle machines 750 r.p.m., 600, 450 and 325 are the usual synchronous speeds, 750 r.p.m. covering all ratings of shop motors. The full-load speeds of all of these motors is about 7 per cent less than the above, and this fact should be allowed for in designing pulleys and countershafting. The average total cost of a 25-cycle plant over a 60-cycle is about 25 per cent, and for this reason for small plants it hardly pays to consider 25 cycles, even if there are to be no arc lamps. In large plants, where there are turbines or gas engines, the advantages of easier paralleling and low turbine speeds make the 25-cycle installation the preferred one. The tantalum lamp-filament lasts longer the lower the frequency, on 25 cycles having almost the life of a direct-current lamp, whereas on 60 cycles it soon becomes brittle.

The synchronous motor, which is sometimes used in induction plants, requires a special exciter and must be running at synchronous speed and be in time-phase with the line e.m.f. before being connected to circuit. It can be started by opening the exciter circuit and treating it as an induction motor. Unless much resistance is inserted in series, the motor will require a heavy current at starting. As the power factor of the synchronous motor is better than that of the induction motor, the former may well be used for large and special loads, such as motor-generators, mine fans and similar equipments where the load can be applied after reaching full speed. When used in a motor-generator set, the generator should be used to start the set, while acting as a direct-current motor. This method is better than starting by connecting the synchronous motor to the line.

In an industrial plant it sometimes happens that several shops must be used before the central power house can be built. A small temporary belted alternator is usually installed to furnish power for these shops, and this can later be used in the power house as a synchronous motor for driving one of the exciters for the main generators.

Method of Investigating the Cost of Producing Electrical Energy.

BY EDWIN D. DREYFUS.

MOST generating stations, especially of the smaller sizes, operate without examining into or making test or analysis of the various factors which enter into the cost or expense of producing electric energy from the available source, as coal, oil, gas or water. Generally the managers of such stations content themselves with the overall results of the relation of kw-hours to tons of coal burned, or otherwise they neglect the segregated items of plant economy through lack of adequate

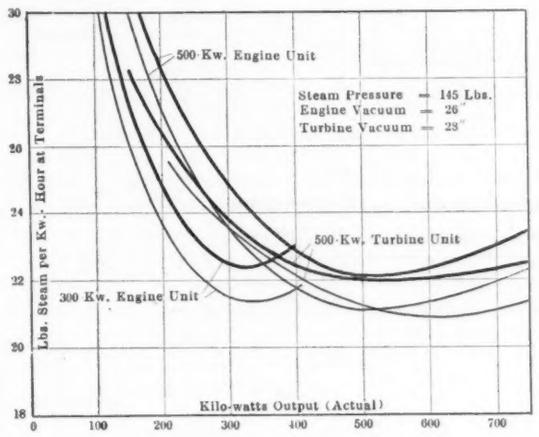


FIG. 1.—STEAM CONSUMPTION CURVES.

knowledge of the efficiencies of the different apparatus comprising the station or by being unable to appropriate sufficient time or funds to determine these factors.

The best analyses naturally are obtained from actual test when operating under the usual working conditions. However, it is found impossible in many instances to conduct exhaustive or even trial tests on the apparatus in service. On the other hand, a carefully prepared diagram or set of diagrams indicating the probable performance of the different elements of the plant may prove useful in detecting and even preventing any wide departure from the best economical working conditions.

The desirability of determining production costs is particularly manifest where a new station is projected, and it becomes necessary to arrive at the ultimate plant economies under different load factors before it has been installed and placed in operation.

The subject of plant efficiencies has received much attention by engineers and operators within the last few years, and unlimited scientific discussions, together with the record of results of practical operation, can be located in past issues of the technical papers and proceedings of engineering societies and associations. The information obtained from these sources will be of value in shaping the various items to be taken under consideration, and often verification can be had by conferring with a friendly central-station neighbor who has previously secured the data from observations at his plant.

In a majority of cases, the manufacturers of the machinery installed will furnish consumption guarantees on their apparatus on request, and these data can be employed as a basis upon which to determine the probable operating results of the plant. The values obtained from the builders of the apparatus are generally based upon their experience in demonstrating the efficiencies of their machines, but such information usually represents figures to be obtained under test conditions only, and proper allowances must be made for actual service operation. In correcting the amounts for working conditions, there are encountered various factors which do not lend themselves to exact calculations, but which can be closely approximated by deliberate and careful judgment based upon past experience and data.

The various problems which present themselves in this work are so numerous that much space and time would be required to cover the entire subject suitably. A single concrete case will, therefore, be cited to outline the procedure to be followed. The plant taken under consideration is to contain two horizontal cross-compound condensing engine units, one rated at 300 kw and the other at 500 kw, and also a 500-kw turbine unit, which receive steam from four 350-hp horizontal water-tube boilers.

The various operating conditions are recorded on the six accompanying diagrams; such factors as are to be assumed as peculiar to the local conditions will be explained later. In presenting the various diagrams herewith, it is to be understood that the curves have been drawn to comply with special local conditions and are not applicable to cases in general.

Taking up these diagrams in consecutive order, Fig. 1 gives the consumption curves of the main units under different loads. For each unit there is one light and one heavy curved line. The light line has been drawn to indicate the performance of the machines under test conditions, while the heavier lines represent the correction for wear and in adjustment of valves incidental to continued service, which results give the probable operating consumptions. As variations from set operating conditions affect the efficiencies of the apparatus in many ways, Fig. 2 has been presented to show (approximately) the increased water-rate of the different types of units due to a decrease of the vacuum.

The consumption of the auxiliaries are apportioned in Figs. 3 and 4. The efficiencies of this class of apparatus are ordinarily very low. With the simple direct-acting boiler-feed pump the steam consumption will possibly range from 90 lb. to 120 lb. per indicated hp-hour developed, and with the small reciprocating engines for the exciter or circulating pumps varies from 40 lb. to 65 lb. per hp-hour. The percentages given on the diagrams correspond to the case assumed, and will vary with different conditions. The leakage and condensation losses have been taken at 2 per cent. In first-class stations with high-grade piping, fittings and suitable pipe covering, this loss may be practically eliminated, while with other plants it may reach almost any limit, depending upon the attention given to this part of the system. In the case in hand it is assumed that all exhaust steam available will be required for feed-water heating purposes, and that the steam-driven exciters will be operated

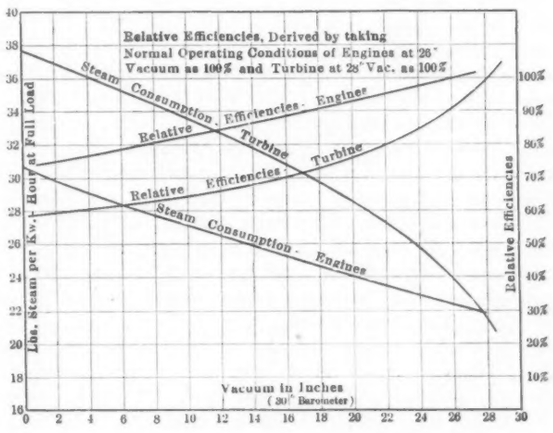
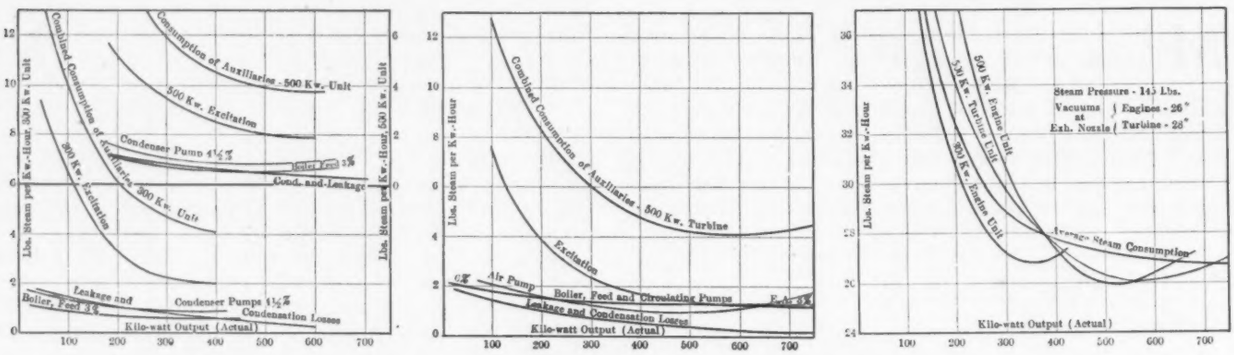


FIG. 2.—CURVES SHOWING WATER RATES.

continuously. Should motor or belt-driven sets be used, the consumptions are to be derived by adding to the main unit consumption the losses in transmission to exciting generator shaft. The sum of the steam consumptions of the main units and the amount chargeable to their auxiliaries are shown in Fig. 5, which affords ready means of determining the total steam consumption of the station for any given output.

The next step is to consider the probable nature of the load curve of the station incidental to railway and lighting service (for example), which will fluctuate considerably, and will appear actually as a broken-line diagram. As the "law of aver-

ages" prevails in most cases, it is permissible to suppose that the purposes will be served in assuming that the load imposed on the station can be represented as a smooth curve. As it will be necessary to cut in and out the different size or number of units to accommodate the valleys and peaks of the load curve it will not be possible always so to place the different machines in service as to obtain the best economies. Therefore, use is made of an average steam consumption curve, allowance being made for the losses entailed in bringing in and taking machines out of service.


Combined Consumption of Auxiliaries - 500 Kw. Unit
Consumption of Auxiliaries - 500 Kw. Unit
500 Kw. Excitation
Condenser Pump 4½%
Boiler Feed 2%
Cond. and Leakage
300 Kw. Excitation
300 Kw. Unit
Leakage and Boiler, Feed 2%
Condenser Pumps 4½%
Condensation Losses
Kilo-watt Output (Actual)
Lbs. Steam per Kw.-Hour, 500 Kw. Unit
Combined Consumption of Auxiliaries - 500 Kw. Turbine
Excitation
Air Pump
Boiler, Feed and Circulating Pumps
Leakage and Condensation Losses
Lbs. Steam per Kw.-Hour
500 Kw. Exciter Unit
300 Kw. Turbine Unit
300 Kw. Exciter Unit
Steam Pressure - 145 Lbs.
Vacuums at Exh. Nozzle { Engines - 26"
Turbine - 28"
Average Steam Consumption

FIGS. 3, 4 AND 5.—SPECIFIC STEAM CONSUMPTION IN POUNDS PER KW-HOUR.

The next step is to ascertain the results obtainable in the boiler room. Some speculation exists here, and often only a rough approximation can be had owing to the wide range in consumptions, which is apparent even in mechanically-fired plants, due to the personal equation of the firemen; these conditions cannot be controlled as well as is possible in the engine room. In Fig. 6 the probable evaporative results under test conditions have been plotted for a mechanically-fired furnace using bituminous coal having a calorific value of 11,500 B.t.u. per lb. with an overall boiler and furnace efficiency of 60 per cent, the power taken by the stoker mechanism being considered. Evidently there will be losses from improper handling of the furnaces, causing over and under ventilated fires, cracks in setting after boilers have been in commission for some time, permitting infiltration of cold air, blowing off of the boilers, stand-by losses, unburned carbon in the ash, etc. The lower curve has, therefore, been added to represent actual service performance. From Fig. 5 the total water rate is obtained, as plotted in Fig. 7, and with the evaporation given on Fig. 6 the equivalent total coal consumption is derived. The coal burned per kw-hour for any stated output is determined from the coal consumption curve.

The next step is to consider the load factor and to produce the equivalent daily kw-hour outputs which correspond to the average station loads which have previously been represented on the diagrams. The load factor of a plant as defined in the standardization rules of the American Institute of Electrical Engineers is the ratio of the average power to the maximum power during a certain period of time. In the absence of any fixed maximum in this case, the load factor will be taken as the ratio of daily kw-hours output divided by 24 to the total rating of the generators in kilowatts. On this basis the load-factor percentages and corresponding daily kw-hour outputs are shown on Fig. 7. The coal is assumed to cost $1.75 per ton delivered in front of the boilers or at the conveyor hopper. The value in cents of the coal per kw-hour output at different load factors of the station is transferred to Fig. 8. The cost of the productive labor is computed from the amount of wages paid the operators, to which should be added the expense of oil, waste and small supplies, and the amount of the repair bills, and plotted in the form of a curve for varying outputs. The sum of the labor, material and coal curves gives the total operating cost at the station for the unit product at any chosen load factor.

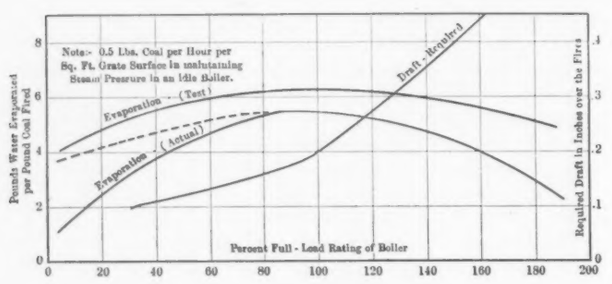

Note:- 0.5 Lbs. Coal per Hour per Sq. Ft. Grate Surface in maintaining Steam Pressure in an Idle Boiler.
Draft - Required
Evaporation - (Test)
Evaporation - (Actual)
Pounds Water Evaporated per Pound Coal Fired
Required Draft in Inches over the Fires
Percent Full - Load Rating of Boiler

FIG. 6.—SPECIFIC EVAPORATION.

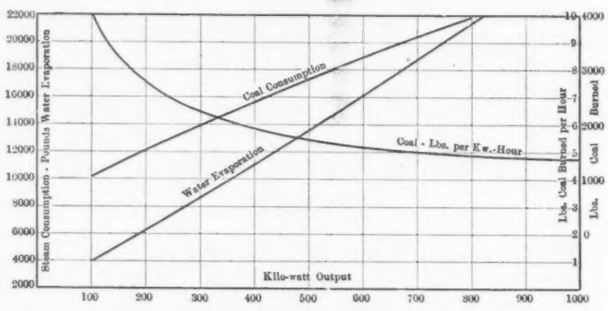


FIG. 7.—HOURLY CONSUMPTION OF COAL AND STEAM.

Annual investment and fixed charges are calculated on the unit basis. In this case the investment per kilowatt installed

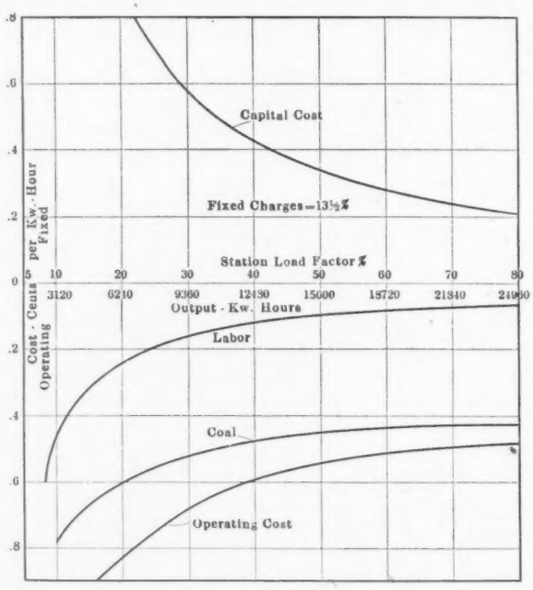


FIG. 8.—CURVES OF COSTS.

is nominally taken at $110, and the fixed charges at 13.5 per cent. These figures can accurately be obtained in any specific case from the actual investment shown on the books, and the fixed charges apportioned from the amount of taxes, insurance, interest, depreciation, annual salaries, etc.

These latter items apply particularly to the accounting system of the business, and as it is an extensive subject in itself and treated in such varied manner by different plants, each manager should determine the exact value applicable in his case.

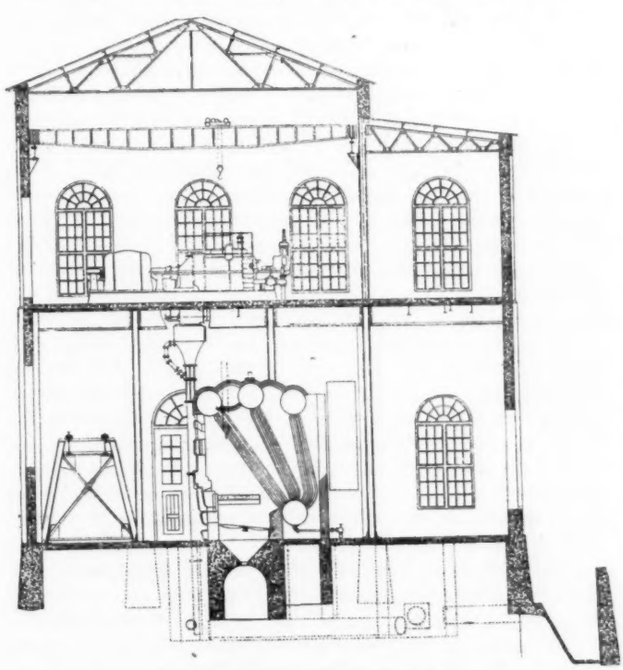
While it has been the intention of the writer to cover the subject treated broadly, he has by no means exhausted the different treatments and considerations that can be given to this important matter; however, he hopes that the suggestions offered will prove useful to the uninitiated.

Double-Deck Steam Turbine Generating Stations.

At the annual convention of the American Institute of Electrical Engineers, held at Atlantic City, Mr. J. R. Bibbins presented a paper dealing with the double-deck generating station. This type of station possesses certain advantages where the building area is restricted, as in cities, harbor frontages, hillside locations, etc. Detailed descriptions were given of two such stations, one at West Point, Ohio, and the other at Fort Wayne, Ind. At the former plant the turbine floor is 33 ft. above the boiler room, which is on the ground floor; at the latter plant the corresponding height is 28.5 ft. The ground area of the West Point station is 2 sq. ft. per kilowatt, while the Fort Wayne plant covers 1.42 sq. ft.

The West Point station was designed to supply energy to interurban railway lines through alternating-current substations. The site chosen is at the foot of a hill where use can be made of the impounded waters of two passing streams for condensing purposes. Coal-handling machinery was avoided, and barometric condensers were used. The most important features of this station, a view of which is given in the accompanying illustration, are as follows:

1. The generating machinery is above the boilers on the second floor of the station. 2. The weight of the generating apparatus is supported entirely by the steel building skeleton. All of the footings are carried down to the same stratum—rock. The box columns are 27 ft. high. 3. The floor structure is continuous, being tied in from wall to wall, thus reinforcing the entire structure. 4. Water-cooled floor columns pass through the middle of the boiler setting to reduce the weight and cost of the beams spanning the battery; all other columns straddle the boiler setting. 5. The barometric condensers are hung from the floor girders directly under the turbine exhaust nozzle. It has been designed for moderate vacuum, and there are no air pumps. 6. The steam piping is simple and direct with few bends, and drains back from the turbine throttle. 7. All important steam header and supply lines are controlled by pedestal-extension valves from the turbine floor; non-return valves are placed in the delivery pipe from each boiler to prevent back-flow. 8. The header serves largely as an equalizer, hence it is small in size (8 in.). 9. The equipment has been designed for 200-lb. pressure and high steam velocities. 10. All auxiliaries are steam-driven so that steam may be had for feed-water heating; the feed-water is taken from the condenser hot-well. 11. The circulating pumps are interconnected for relay working and are primed by steam siphons or by the service pump. 12. The pump suction pipes are submerged 8 ft. in the intake bay to avoid surface air. 13. There is a two-story side addition for accommodating the transformers. 14. The operating switchboard is located in the division wall, leaving a clear rectangular operating room and a separate switch room. 15. The generators are air-cooled by positive blast piped from the outside in order to reach cooler air and to avoid the possibility of steam from the boiler room reaching the insulation. 16. The turbine bedplate is leveled on the plate girders throughout its length with a cast-lead pad 1 in. thick. 17. There is a reserve exciter unit, steam driven, the exhaust steam being taken to the heater. 18. The transformers are mounted on trucks to facilitate replacement by a reserve unit which is provided. 19. An ash hoist is to be installed from the level of the ash tunnel to the level of the siding track. 20. The crane reaches the basement through a removable section of the flooring. 21. The flue connections pass directly to the stack, there being no bends. 22. The steel stack is self-supporting and brick lined. 23. There is an elevated tank in the turbine room to provide a head for the gland water and building service.



DOUBLE-DECK TURBINE STATION.

The arrangement at Fort Wayne differs in certain details from that at West Point. The stokers at Fort Wayne are served by an exterior coal bunker running along the face of the building, while at West Point a coal trestle forms the storage. The Fort Wayne station employs directly-driven exciters mounted at the end of the turbine shaft.

COST OF 5800-KW DOUBLE-DECK STATION; NO SUBSTATION APPARATUS.

	Building.	Total per kw.
Building: Including general concrete and steel work, coal bunker, smoke flue, condenser pit, coal storage pit, etc.	$93,217	$10.97
Generating plant: Including turbines, generators, exciters, cables, switchboards, transformers and ventilating ducts	259,711	30.55
Boiler plant: Including boilers, superheaters, stokers, piping, pumps, heaters, settings, breechings and tank	118,313	13.92
Condenser plant: Including condensers, pumps, piping, free exhausts, water tunnels and intake screen	33,790	3.98
Coal handling plant: Including gantry crane, crusher motors and track	7,990	0.94
Erection, superintendence and engineering	50,500	5.94
Total, excluding property and siding	$563,520	$66.25

The accompanying table, which relates to the Fort Wayne station, which will contain 8500 kw of apparatus when completed, indicates the exceptionally low cost of the double-deck station.

Tantalum Lamps.

A 25-volt tantalum lamp for use with automatic transformers, and on low-voltage circuits generally, is being introduced in England. The new lamp is for voltages of 24 or 25, and is supplied in 6 cp or 16 cp. The filaments used in these lamps are said to be very strong. The 25-volt lamp may be used for train lighting or private house installations, especially in connection with small transformers. The bulb is smaller than that of the ordinary carbon filament, but similar in shape. The lamps can be placed in any position.

Liabilities of Electric Companies for Accidents Due to Fallen and Broken Wires.

By John E. Brady.

THE right to recover damages from an electric company for injuries resulting from contact with a broken or fallen wire belonging to the company depends always upon the negligence of the company, and if the negligence be not shown, the company is not liable. Where the company has used reasonable care in placing its wires and keeping them in proper repair there is no liability although damage in fact ensues. In the case of Baltimore City P. R. Co. v. Nugent, 86 Md. 349; 38 Atl. 779; 39 L. R. A. 161, where a passenger on a trolley car was injured by the trolley wire breaking and striking him, the shock causing him to fall to the ground greatly to his injury, it was held that the company was not liable, on the ground that the accident was due to a hidden defect in the wire which could not have been discovered upon reasonable examination. It was there said by the Court: "All actions of the kind we are now dealing with must be founded upon negligence of the defendant, both asserted and proved. If there be no negligence, though there be an injury, no action will lie."

The mere fact that the breaking or falling of an electric wire has caused damage does not render the company owning the wire liable at law. As was said in 31 L. R. A. 579: "It is clear that, although the maintenance of the lines is wholly within the care of the electric company owning them, yet its supervision cannot be constant on all parts of the line, and that, while most fallen or sagging lines show that the construction or repair of the line was not properly cared for by the company, yet in some cases, as where wires are loosened or thrown down by high storms, or other natural causes, the company is not to be blamed for its mere falling or sagging, but only for allowing it to remain in the highways an unreasonable time afterwards." In New Omaha Thomson-Houston Electric L. Co. v. Anderson, Nebraska, 102 N. W. 89, it was held that a fireman was not entitled to recover damages where he was injured while in the act of raising an aerial ladder, due to the ladder's coming in contact with the uninsulated electric light wires of the defendant company. The following statement is quoted from the opinion: "The cases seem to establish that in the absence of any statute or ordinance prescribing a duty toward foremen on the part of the owner of premises, the latter is not liable for anything short of a designed injury." The evidence in this case was not positive as to the defective insulation of the wires, because it appears that the sharp edges of the ladder might have cut through the insulation. It was held, nevertheless, that "the fireman had no right to rely upon any insulation."

Where wires are properly erected and maintained and are thrown down in numerous places, at the same time, the electric light company is not liable as a matter of law in allowing one of the wires to remain unattended to for several hours. This was the holding of Boyd v. Portland Electric Co., 37 Oregon, 567, Pac. 378, where is was said: "Whether the defendant company had in its employ a large enough force of men to meet the emergency and whether its want of assistance was an adequite excuse for its delay in not sooner taking care of the wire which caused the plaintiff's injury, were proper matters for the consideration of the jury in determining the question whether it had used reasonable care and diligence." It has been expressly decided that where the wires of a telephone company fall upon the street of a city, it is the duty of the company to remove or repair them only after reasonable notice. Nichols v. Minneapolis, 33 Minn. 430; Hand v. Central Penn. Tel. & Supply Co., 1 Lack. Leg. N. 351. In Hand v. Central Penn. Tel. & Supply Co., I Lack. Leg. N 351, it was held that a telephone company was not liable for injuries resulting from contact with one of its wires which had broken and fallen across an uninsulated guy wire of an electric railway company, the Court saying at page 359 of the opinion: "The defendant company can only be convicted of negligence in case it knew or ought to have known that the wire was in such a defective condition that it should have been taken down." It was also here held that it was the duty of the company to remove wires which fall upon the street only after reasonable notice. In a Nebraska case it appeared that an ordinance required electric companies to send one or more competent linemen to fires, then to report to the city electrician and remove wires where necessary. It was held that this imposed no duty upon the defendant electric company beyond the furnishing of a competent lineman, and that the company was not liable, even though it was shown that the company's lineman invited the firemen to proceed to lower the ladder, saying that the wires, with which it thereupon came in contact, and which proved to be heavily charged, were dead. New Omaha Co. v. Anderson, Nebraska, 110 N. W. Rep. 569.

There are, of course, many cases in which electric companies have been held liable to parties injured by coming in contact with their wires, but it is to be noted that in such cases it appears that the company has had notice of the dangerous condition of its wires, either actual or constructive. Thus, an electric company was held liable where it was shown that notice was given to one of its employees in charge of the power house that one of its poles was afire and one of its wires down, and that, though he had authority to turn off the current, he did not do so, and that an inspector who was sent out did not make an inspection within a reasonable time thereafter. Luthold v. United Elec. L. Co., 184 Mass. 53, 67 N. E. Rep. 1025.

The company was held negligent where notice was given to the superintendent that a wire was down, and it was nevertheless permitted to remain down from 2 a. m., the time when notice was given, to 6 a. m., when a passerby was killed by contact with it. Texarkana Gas & E. L. Co. v. Orr, 59 Ark. 215, 27 S. E. Rep. 66. And where an electric light company permitted a live wire to remain on the surface of the street for a period of three weeks, it was held that the court would presume from the length of time that the wire was permitted to remain on the street that the company had had notice of its condition and that the company was liable. City of Kansas v. File, 60 Kan. 157, 55 Pac. 887.

It is a general rule that the defendant's alleged negligence, in order to render him liable, must have naturally and proximately caused the injuries complained of. Henry v. Southern Pa. R. Co., 50 Cal. 183; Davis v. California St. Cable R. Co., 105 Cal. 131. It is not always a matter of ease to determine exactly what constitutes the proximate cause of the accident. In Allen v. The Atlantic & Pacific Telegraph Company, 21 Hun. 22 (N. Y.), the plaintiff sought to recover for injuries resulting from the falling of a telegraph pole which was knocked down by being run against by a runaway team. It was shown that the pole was somewhat decayed at the time, and the court decided that the proximate cause of the accident was not the falling of the pole, but the collision with the team, and that, therefore, the telegraph company was not liable. Where a telephone wire, suspended over a trolley wire, was broken by an unusual storm and fell across the trolley wire and thence into the street, where it killed a horse, it was held that the trolley wire was not the proximate cause of the accident, and that the company could not be held in damages. The proximate cause of the accident, it was determined, was the falling of the telephone wire. City of Albany v. Waterliet R. & R. R. Co., 76 Hun. 136, 27 N. Y. Supp. 848.

In another instance the plaintiff, a fireman, while responding to an alarm, found a telephone wire breast high across the path of the engine, and was injured by electric shock while attempting to remove it. The wire was an abandoned one belonging to one of the defendant companies, and was not supported by poles, but was attached by brackets to wooden buildings, with spans of from 168 to 519 feet. The burning of one of the buildings caused the wire to fall upon an unprotected light wire belonging to the other defendant company, and carrying 2500 volts, which was strung about 8 ft. below. There was evidence that insulation or a guard wire over the electric light wire would have prevented the contact and consequent injury.

It was held that the failure to properly protect the wires and not the burning of the building was the proximate cause of the injury, and a verdict was rendered against the defendants. Horning v. Hudson River Telephone Co., 111 App. Div. 122.

The proximate cause of the injury was the fire, which was an act of God.

Where a pedestrian in a city street was injured by a trolley wire, broken by an unavoidable accident, which struck him while falling, he was held to have no action against the company. Cook v. Wilmington City Electric Co., 9 Houst. 306, 32 Atl. 643. And the owner of a building, one wall of which fell, because of the action of a fire within the building, was not liable to a fireman who was injured by the fall. Kitchen v. Carter, 47 Neb. 776, 66 N. W. 855. In Mitchell v. Charleston Light & Power Co., 45 S. C. 146, 22 S. E. Rep. 676, 31 L. R. A. 577, an action brought to recover for injuries received from contact with an electric wire broken by a storm and left hanging in the street, though a verdict was found for the plaintiff, the court said in the charge to the jury: "The law does not require impossibilities. If a cyclone that could not be anticipated, or reasonably foreseen, was the cause of that wire falling, and the company was not negligent in allowing it to remain there for an unreasonable time, then, under those circumstances, it would not be liable." Where the accident, for which action is brought, occurs upon the premises of a third person, the company owes no greater duty to the plaintiff's interstate than does the owner upon whose premises the injury is done. In other words, an electric company which maintains wires on or over the premises of another with his consent may avail itself of the rule which holds the owner of the premises to only a low degree of care and responsibility toward a trespasser or bare licensee. 3 L. A. R. 988. In the case of Cumberland Telephone & Telegraph Co. v. Martin, 76 S. E. 394, 25 Ky. Law Rep. 787, it was held that a telephone company was not liable in damages where it appeared that a person, who had taken refuge from a storm under a porch was killed by lightning communicated to him by means of a wire belonging to the company, attached to the metal roof of the building, and an iron grating against which he was leaning. The deceased was a bare licensee upon the premises, and under the rule stated the company owed him no duty to properly maintain the wire. It was said in the opinion that there was sufficient evidence of negligence in the way in which the wire was attached to the building to allow the case to go to the jury, if the defendant owed any duty to the deceased or its negligence was the proximate cause of the death. If the defendant company had owned both the building and the wire it would have been under no responsibility, as the deceased was a bare licensee on the premises, and it was certainly under no greater responsibility where it owned only the wire. This conclusion was reached in spite of the fact that it appeared that the owner of the house had directed the telephone company to remove its wires, and that, at the time of the accident, it had no right to have its wires attached to the building.

A number of cases involve the right of a fireman to recover damages from an electric light company for injuries received while engaged in his duty. It has generally been held that the requirements of reasonable foresight and reasonable precaution to prevent injuries to another do not impose a duty upon the owner of premises to maintain them in a reasonably safe condition for those who come thereon solely for their own purposes and without any inducement, allurement or express or implied invitation, but as mere licensees of the owner of the premises. 21 Am. and Eng. Encyc. of Law (2d Ed.), 475, citing Berlin Mills Co. v. Crotean, 88 Fed. 860; and it is also a general rule that firemen are bare licensees. Gilson v. Leonard, 37 Ill. App. 344, Woodruff v Bowen, 136 Ind. 431. "In the absence of any municipal ordinance or statute changing the rule, a fireman who enters upon property without any special authority or invitation of the owner is a bare licensee—made such by public necessity—and takes the risk of the premises as he finds them." New Omaha Thomson-Houston Electric L. Co. v. Anderson, Supr. Ct. of Nebraska, 102 N. W. 89. And when they are injured, while at work, by the contact with the wires of an electric company, the company is liable only where the injury was intentionally or wantonly inflicted. Tronton v. New Omaha Thomson-Houston Electric L. Co., Neb. 110 N. W. 569.

In Gilson v. Leonard, 37 Ill. App. 344, a fireman sued the owner of a building for injuries received by the falling of an elevator in which he was descending to the basement of the building while engaged in the work of putting out a fire. It was said in the opinion, at page 350: "The law gives a license to enter upon private property to save property from fire, but charges the proprietor with no duty towards those who enter." And in Woodruff v. Bowen, 136 Ind. 431, it was said: "The owner of a building in a populous city does not owe it as a duty at common law, independent of any statute or ordinance, to keep such building safe for firemen or other officers, who, in a contingency, may enter the same under a license conferred by law." This was an action for the death of a fireman, who was killed as a result of the caving in of the roof of the defendant's building, on which he had gone in the prosecution of his duties as fireman. It was held that the fireman was a licensee, having entered the premises "under a license created by an overruling necessity"; and that the defendant owed the fireman no duty, "certainly not the active duty of diligence to see that no harm comes to him, and when the latter, without any invitation, and pursuant to a mere license, enters the former's premises, he takes the risk of whatever dangers may be there. The law is so laid down in the text books and is established by a multitude of decisions." It was further said: "We think the authorities fully establish the rule that the lincensor owes to the mere lincensee no duty except that of abstaining from any positive wrongful act which may result in his injury, and that the licensee takes all risk as to the safe condition of the premises upon which he enters." In Hamilton v. Minneapolis Desk Mfg. Co., 78 Minn. 3 80 N. W. Rep. 693, the plaintiff, a fireman, was injured while in defendant's building, in the discharge of his duty, through defendant's negligence in failing to place guards around an elevator shaft. It was held that he could not recover damages, the rule being stated as follows: "By the rules of the common law, a fireman going upon the premises of another, under the circumstances appearing in this record, could not recover damages for such injury. However hard such a rule may seem, it appears to be settled that the owner or occupant of a building owed no duty to keep it in a reasonably safe condition for the members of a public fire department who might, in the exercise of their duties, have occasion to enter the building."

Wiring from the Contractor's Standpoint.

At the convention of the Association of Railway Telegraph Superintendents, held in Montreal, Canada, June 24, 25 and 26, Mr. J. H. Jacoby presented a paper with the above caption. The electrical contractor, he says, may have views differing somewhat from those of others who have in charge the erection of a depot or other building; and it would appear but natural that he should be inclined to recommend all the various up-to-date appliances and a liberal distribution of them throughout the building, as well as ample provision for a maximum amount of lighting. Whereas the builder, generally being of an economical trend, especially in the matter of electrical equipment, would not be so liberally disposed. In Mr. Jacoby's opinion the contractor should be an engineer as well, although in most cases he simply has to follow the plans and specifications handed him; however, suggestions or recommendations for improvement from him are frequently found to add much to the electrical completeness and excellence of the work made.

In wiring, the first and foremost consideration is that of safety, and if the most ordinary precautions are taken and the rules fairly well complied with, there is hardly a possibility of fire. From a number of years of experience in this particular field, Mr. Jacoby is persuaded that electricity is the safest illuminant known.

The underwriters' rules differ somewhat in the various districts, in some details, but generally they are a unit on essen-

tials and it may be said that these rules having been compiled from all the varied experiences and mishaps of the past, are as near perfection as any body of men specializing along certain lines can make them. One of the differences noted is the adoption of certain insulated wire for concealed work. In some districts rubber-covered wire is required, while in others fire and weatherproof insulation is called for. Mr. Jacoby prefers the latter wire for depot work for the reason that the insulation is more durable. In rewiring buildings this fact has been particularly noted by him as well as by others who confirm the statement. Yet it cannot be said that there is any particular element of danger in the use of rubber-covered wire when properly installed. The author recommends the iron conduit system of wiring as being the safest, and cited his experience with the old paper conduit now no longer used.

Every depot should be provided with abundant light, with proper distribution and location of outlets. For beauty and attractiveness the lighting effect can scarcely be ignored. A depot may be decorated and furnished in the most lavish manner, yet if improperly lighted will lose much of its luster and beauty and the saving thus effected prove a false economy. Lighting outlets with proper fixtures should be carefully located with due regard for height of ceiling and area to be covered, as well as the room furnishings. Every avenue, passageway, corner and nook should have its proportion of light, eliminating all dark and gloomy spots.

The economical side of depot wiring is frequently placed first on the list by reason of the fact that appropriations are lacking and in scaling down the electrical equipment is the first to suffer. Mr. Jacoby is strongly in favor of an underground service entrance for depots, stating that it has been demonstrated that underground construction can be made perfectly secure and reliable, and while perhaps somewhat more expensive in first cost, will undoubtedly prove a saving in the end; and besides it is much neater.

Wave Winding for Direct-Current Armatures.

By George T. Hanchett.

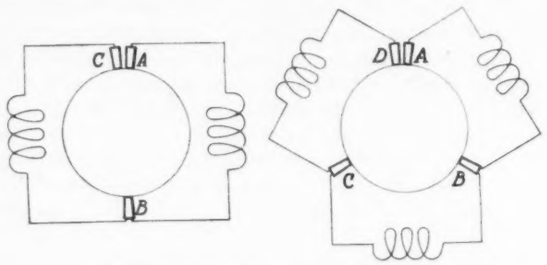
A dynamo designer has no difficulty in determining the pitch of the winding, the number of slots, and the number of commutator bars, so that it will "wind" and be electrically correct from a circuit standpoint. He may have some trouble in selecting these quantities for the best results; but to arrange the circuits once the problem is solved is comparatively an easy task.

The armature winder does not always have the same facility in determining matters of this kind. Many armature winders, and it may be added, highly skilled men, either wind exactly as they are told or reproduce what they have seen without any knowledge as to the reasons for so doing. It has been said of some skilled winders that they could take a barrel of scrap wire, empty it, and replace the wire therein with every turn and twist exactly as it was before. This combination of memory and mechanical accuracy, while it avails much in reproducing what is known, is of little value for solving a new problem. For instance, if a lap winding requires to be changed into a wave winding, how many bars, if any, and how many coils, if any, should be cut out? This is a problem which often falls to the lot of the winder that he is not always able to solve. For the purpose of readily determining these facts the writer devised a simple rule which may be of interest.

In the case of a four-pole winding, draw a circle representing the surface of the commutator, and from bar *A* draw a coil wave-fashion around to some bar on the opposite side of the commutator and thence back again to the bar *C* adjacent to bar *A*, as shown in Fig. 1. There are now three bars connected, and the bars in the sections thus laid off must be equal in number in order to preserve the symmetry which is essential to any winding. Thus it will be seen that a four-pole wave winding must have an odd number of bars, for the reason that twice any number plus three is always odd.

A similar method applied to a six-pole winding is shown in Fig. 2. In this case the wave-wound coil or series of coils divides the commutator into three sections, each of which must contain an equal number of bars, and it will be noted that the bars dividing the sections now number four instead of three. Hence the number of bars of any six-pole winding consists of three times a certain number plus four, and it will be evident that a six-pole winding may have either an odd or an even number of bars. If the triply-multiplied number be odd, the total number of bars will be odd, and if the number be even, the total number of bars will be even.

As a practical problem, suppose a six-pole armature with a commutator having 96 bars. Is it possible to use a wave winding and employ all the bars? Subtracting 4 from 96 leaves 92,



FIGS. 1 AND 2.—WINDING DIAGRAMS.

and it is seen at a glance that this remainder is not exactly divisible by 3, and that the nearest number that is exactly divisible by 3 is 90. Adding 4 to this gives 94 as the nearest number of bars which will wind wave-fashion, and if the present armature and commutator are to be used, two bars must be bridged and two coils cut out.

The same line of reasoning can be carried through with an armature of any number of poles, the following general rule applying: The total number of bars minus one-half the number of poles and minus one must be exactly divisible by half the number of poles. Expressed as an equation,

$$\frac{n-\left(\frac{p}{2}-1\right)}{\frac{p}{2}} = \text{a whole number.}$$

This rule, of course, applies only to the simplex, singly-reentrant wave winding and does not apply to the sandwich wave winding, or multiple winding, as it is sometimes called. It is seldom, however, that the average armature winder who has to deal with all sorts of problems and may have occasion to use rules such as this, encounters these more complex windings under conditions where he requires to apply methods of this character.

The Use of Culm by Central Stations.

In the minds of many there is an impression that the logical location for an electric lighting plant is at the mouth of a coal mine or alongside of the culm banks adjacent to the mines. However, what is to-day known as a rule, culm at the mines cannot be used in boiler furnaces except in the form of briquettes, for the reason that all coal larger than buckwheat No. 3 has been washed out of it and shipped to market. True, these huge banks contain plenty of carbon, and the briquetting of the fuel has been attempted from time to time without very great results. The fuel might be burned in the form of powder; but so far nothing has been done in this direction, the larger coal being cheap enough at the mines and the culm being too expensive owing to transportation charges to make its use economical in places distant from the mines at the present time.

In the anthracite regions, however, there are still a number of old culm banks owned by private concerns other than coal companies. These banks contain coal as large as pea and nut and for that reason are valuable, since means have been devised for burning the smaller sizes of anthracite. Culm banks of

this kind owned by the coal companies are being washed for the buckwheat, rice, bird's-eye and barley sizes, for which a large market exists. Indeed, the demand for these sizes is so great that they are hard to obtain by persons in the anthracite regions except by contract, the railroad companies, which are closely allied to the mining companies, preferring to draw the coal to New York and thus earn the freight charges. The price of the coal is, of course, also increasing.

Some electric light companies in Pennsylvania are fortunate enough to own culm banks containing sufficient coal to meet their needs for decades to come. Other electric companies, however, can purchase coal at very low rates; but strange as it may seem, steam power is as a general thing comparatively expensive although coal is cheap. The question of water supply is becoming more and more serious throughout the whole anthracite region, so that so far as economy is concerned, the water supply for boilers and for condensing apparatus, where such is installed, is a limiting feature. Nearly all the available water supply is owned by the railroad companies or by water companies, and only in a very few localities can water be secured by driving wells, as the territory is underlaid with coal and the water obtainable is filled with acids and impurities in sufficient quantities to eat up a boiler in a short while. What few remaining streams there are unpolluted are being rapidly converted into black and muddy streams by the water from the washeries and breakers, together with water from new mines opened. Nearly all of the electric light companies, therefore, buy their supply of water from the cities or companies controlling the good water.

The Scranton Electric Company owns three culm banks in and around Scranton. The Suburban station is located on a hill alongside of one of the culm banks in which coal as large as chestnut exists. From this bank the Lackawanna Light Company's station and the Scranton Illuminating, Heat & Power Company's station, besides that of the Suburban Electric Light Company, already mentioned, are supplied with coal. All of the electric light stations in Scranton are controlled by the American Gas & Electric Company, of Philadelphia, Pa. The coal is taken directly from the culm bank by a conveyor and delivered to a motor-driven crusher where it is ground to a size about bird's-eye. No attempt is made to wash the coal, and slate, rock, etc., are all ground together, the rather astonishing claim being made that the fuel shows a higher calorific value in this condition per ton taken from the banks than it did when it was washed. From the crusher, the fuel passes directly to the boiler room of the Suburban station. The cost of the coal delivered into the boiler room is estimated as 12 cents per ton. The cost of the coal delivered into the bins of the other two stations is estimated as 40 cents per ton, the cartage costing more than the fuel. With the installation of a new turbine unit in the Suburban station a condensing unit was installed, and since water must be purchased, a cooling tower was erected so as to cut down the water expense.

The coal used naturally runs high in ash, and an elevator system was heretofore used to deposit the ash in place of the coal taken from the culm bank. It is proposed now to install a suction system for lifting the ashes to a large tank from which they can be distributed to all parts of the culm-bank grounds. The fuel is burned in various types of boilers, having large grate surface and shaking grates. In order to keep the fire free from clinkers, exhaust steam is turned into the blast duct, the furnaces being fitted with firebrick arches and forced draft used. The Stirling boilers in the Lackawanna Light Company's station are also fitted with Dutch ovens, an air blast with exhaust steam being used in burning the fuel. As a rule shaking grates show up very well with coal high in ash.

In the Hampton station of the Delaware, Lackawanna & Western Railroad Company, rejected barley coal is burned in boilers fitted with firebrick arches and pin-hole grates. In the same station McClave stokers are in use burning rice coal under water-tube boilers. Hard-burned, fine-ground Monroe brick is used in the arches and superheated steam is used with the blast. The new boilers are fitted with the Parsons system of pin-hole grates, the ratio of heating surface to grate surface being as 30 to 1. The stokers were installed many years ago and give good service. In this plant 8½ lb. of water are evaporated per pound of fuel on an average.

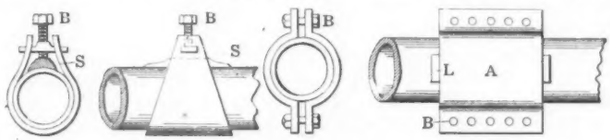
In the power station of the Lehigh Coal & Navigation Company, at Lansford, Pa., which supplies energy to the lines of the Panther Valley Electric Light, Heat & Power Company, refuse heretofore employed for quenching fire in a burning mine at Summit Hill is burned on pin-hole grates under a fire-brick arch. In this station motor-driven fans were first used to supply the necessary draft and exhaust steam was mixed with the air to keep out clinker in the fire. The result, however, has not been satisfactory and the fans have been displaced by steam jets. It appears that this is the only way that the operating force has been able to keep the clinker from forming in the fire with the fuel used. In this plant Maxim water-tube boilers built for burning cheap fuel are used.

Emergency Repairs to Steam Pipes.

By WILLIAM KAVANAGH.

In generating stations it is as important for the operators to be prepared for leaks and breakdowns in steam-pipe lines as for accidents to boilers or engines. In many instances it is possible to effect repairs to boilers or engines without shutting down the machinery or interfering with the output of the station. If the accident be serious, the units may be cut out of service and the load carried by the other apparatus until repairs are made or until the engine or boiler usually installed for emergency use can be got under way. Main headers and feeders in steam-pipe lines are usually installed in duplicate so that should a break occur in one, the other is brought into use by opening and closing certain valves. Actual breaks in properly constructed steam-pipe lines are of rare occurrence, however, the chief causes of worry to the engineer being leaks in the lines. Leakages in the pipe-lines should be repaired as soon as discovered so that the operation of the plant may go on as usual and unfavorable reports and dissatisfaction from various sources may be avoided.

Most engineers are familiar with the clamp shown in Fig. 1. This type of stopper is very serviceable for leaks in pipes of small diameter since it can be applied while steam is in the pipe

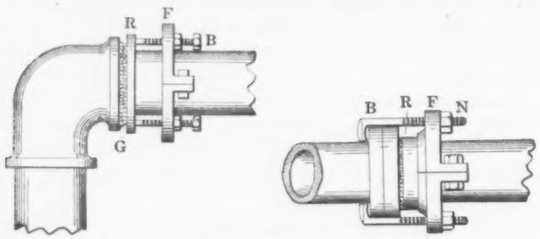


FIGS. 1 AND 2.—EMERGENCY PIPE CLAMPS.

and does not require stopping any unit. The form of clamp shown is not serviceable, however, on flanges, tees, elbows or fittings in general, and it is seldom employed on pipes over 2½ in. in diameter. In applying the clamp to a steam pipe, the saddle *S* is placed over the break and a strip of sheet lead or rubber placed between it and the pipe. By screwing up the bolt *B*, the rubber or lead gasket is pressed into the hole and the leak stopped until a favorable opportunity presents itself for inserting a new piece of pipe in the line.

Fig. 2 illustrates another form of clamp which is employed on pipes of large size carrying steam under high pressure. The clamp, which is made of iron and is in two parts, is bolted in such a way as to bring one side of the clamp over the hole or crack in the pipe. As shown in Fig. 2, the leak at *A* is covered with one-half of the clamp, which has a curvature corresponding to that of the pipe. A piece of sheet lead, copper or rubber packing is inserted between the clamp and the pipe and then the flange is tightened somewhat and driven over the leak. This is done in order to prevent injury to the men making the repairs. The gasket is indicated at *L*, and it is evident that when the clamp is once in position, a great pressure can be brought to bear on the leak by means of the bolts *B*. In this way the leak can be stopped.

When the leaky steam pipe is large in size and its removal for the purpose of inserting a new pipe would occupy more time than could be afforded, the addition of an iron cement known as "smoothon" will materially assist in making the repair permanent. When this substance is to be applied, assuming that the steam is shut off, the surface around the leak should be well cleaned before the smoothon is mixed and plastered over the faulty spot. While the cement is still plastic, the split

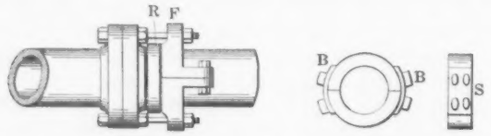


FIGS. 3 AND 4.—METHODS OF STOPPING LEAKS AT JOINTS.

flange and gasket can be placed in position and firmly fastened. It will be found that by this means leaks can be effectually stopped and the repaired part will last as long as the pipe itself.

Whenever leaks occur on flanges, tees, elbows or fittings, it becomes a difficult matter to stop them. Fig. 3 illustrates a method for stopping leaks on elbows, tees or flanges. A ring *R*, free to move along the pipe, is placed around the pipe and a split flange *F* is bolted on the pipe, as shown. By means of the bolts *B* the movable split ring is caused to compress a ring of rubber into the hole or crack, as shown at *G*. In placing the flange *F* in position care must be taken to prevent the flange from slipping when the pressure is brought to bear on the bolts *B*. A device of this kind is capable of stopping a leak against a pressure of 80 lb. Moreover, the device can be quickly applied and will be found useful where the pressure is not high. When the working pressure is between 150 lb. and 250 lb., the stoppage of leaks is not an easy task. Fig. 4 shows a method of stopping a leak between a pipe and any flanged fitting. The device used consists of a movable split ring *R* and a movable split flange *F*. The flange is drilled to receive a number of bolts shaped and bent over the main flange, as shown at *B*. A strip of lead or of rubber is placed around the pipe before the split ring and flange are placed in position and the bolts inserted in the movable flange as shown. By screwing up on the bolts *N* the flange *F* is made to compress the ring *R*, which in turn compresses the strip of lead or of rubber into the crack or hole, thus stopping the leak. A device of this kind is useful for stopping leaks when the pressure against which it has to work is not over 125 lb. A disadvantage with higher pressures is that the bolts tend to straighten when the strain is applied to the nuts *N*. The use of smoothon with this type of leak stopper will be found beneficial.

A device applicable to all flanged fittings and differing slightly from that shown in Fig. 4 is shown in Fig. 5. Bolts sufficiently long to extend through the main and movable flanges are applied as indicated. The bolts should have the same diameter as the original flange bolts and an extra set of nuts should



FIGS. 5 AND 6.—CLAMPS FOR LEAKY FITTINGS.

be provided so as to permit the main flange to remain intact while the movable flange slides along the pipe and compresses the movable ring *R*. In applying the device it is not necessary to remove all of the bolts from the leaky flange at once, and steam may remain in the pipe and the plant kept in operation while repairs are being made. The movable ring is made of copper and a lead or rubber strip is inserted between the main flange and ring, so that when the nuts are screwed up, the movable ring will compress the strip of rubber or lead into the hole and stop the escaping steam. The split rings are joined when in place by means of two straps, as shown in Fig. 6. The straps are fastened to the ring by means of tap bolts, shown at *B*. The ring is cast and turned in a lathe to fit the pipe and then sawed in half and fitted with the straps. The sawing of the ring lessens its diameter, and in order to overcome any difficulty, the holes in the strap are slotted or made oblong, as shown in the side view at *S*, so as to permit the ring to slide over any irregularities that may exist on the surface of the pipe.

Automatic Damper Regulators—III.

By W. H. Wakeman.

In the first issues of May and June a number of damper regulators was described by the writer, and in the present article the writer concludes the series on automatic damper regulators. Fig. 1 is another form of regulator in which both steam and water pressures are used. Steam at boiler pressure is required at 2 and a drip pipe to carry off the water of condensation is connected at 3. Water at not less than 35 lb. pressure (and more is better) is admitted at 4, and after it has been used it is allowed to escape through 5. A drip pipe for a small quantity of waste water is connected at 6. There are three levers with suitable weights shown. The upper one is for making the regulator very sensitive to changes in the boiler pressure. The middle one counterbalances the boiler pressure, acting on the piston, the operation of which is as follows: So long as boiler pressure is below the limit this weight stays in its lowest position, but as this limit is approached, the weight rises, and when the limit is fully secured it rises to its highest position.

The damper lever is attached to the outer end of the lowest lever and this is raised by water pressure acting on a piston in the water cylinder 7, thus completing the operation and controlling the draft so that boiler pressure varies less than 1 lb. when the fires are in first-class condition. This is called a high-pressure regulator, because it is designed for use where 20 lb. or more are carried, there being no limit to the high pressure for which it is suitable.

Fig. 2 is somewhat similar to the foregoing illustration, except that the upper lever is omitted and the top is fitted with a diaphragm instead of a cylinder and piston. Connection is made so that boiler pressure is secured through 2 to operate the diaphragm, thus keeping a body of cold water to act on the rubber and prevent it either from drying up for lack of moisture, or from being destroyed by the heat of live steam. Otherwise the operation is the same as that of the regulator shown in the first issue for June. The regulator, however, is only intended for less than 20 lb. pressure.

Fig. 3 illustrates another regulator in which water pressure is utilized to operate the damper. Boiler pressure is admitted at 2, and passing to the diaphragm 3 it raises the weighted lever 4, when the limit of pressure is secured. This action opens the valve 5 and admits water through 6 to the cylinder 7, where it forces a piston upward and closes the damper. The small lever 8 is carried upward by the attachment 9, the effect of which is to shut off water at 5 and trap the water already in 7, holding it there for the purpose of keeping the piston in its highest position until properly released. When the boiler pressure falls about 1 lb., 4 is lowered and this opens what may be called an exhaust valve in 5, which allows the water to escape from 7, hence the piston falls and opens the damper.

Fig. 4 illustrates a regulator in which a piston moves downward to close the damper. Boiler pressure is admitted at 2 and acts on the diaphragm shown, therefore when the limit of pressure is reached, the weighted lever 3 is thrown upward, carrying with it the connecting rod 4, which raises the small valve 5. Water under pressure is admitted at 6, and when 5 is raised, it allows this water to pass through the port shown and act on the piston 7, which it forces downward, winding up the chain and closing the damper.

A cam is attached to the wheel 8 and as it revolves this cam engages the bell crank lever shown in dotted lines, and moving it toward the left hand depresses the jointed lever 9, and this tends to close the valve 5, the effect of which is to prevent the regulator from being over-sensitive. An appliance for opening and closing the damper of a steam boiler should operate on a very small change in pressure, but over-sensitiveness only results in fluctuation of the mechanism, giving unsatisfactory results. When the boiler pressure falls about 1 lb. it allows 3 to lower, shuts off the water pressure and causes the water already above the piston to flow into the sewer, hence the weights on the damper lever (not shown in the cut) open the damper and put full draft on the fire. This action raises 7 ready for the closing operation again as soon as the maximum boiler pressure is secured.

One important point in connection with this subject should not be overlooked, nor its value underestimated, as it relates to the safety of steam boilers. If a boiler is not equipped with an automatic damper regulator, a good fire may be built under it, after which the fireman will attend to other duties, and cases are not unknown where he has gone to a distant part of the plant, remaining away until high pressure has caused the safety valve to blow fiercely, not only wasting much heat, but filling the boiler room with steam that alarmed timid employees and caused much trouble. Safety valves do not always open when they ought to, and there is no good reason why they should not fail to operate at such critical times. If a boiler is fitted with a good damper regulator, the draft will be shut off when the working pressure is secured, hence there is little danger of a destructive pressure, as the rise will then be very slow, if there is any increase at all, hence a damper regulator may also properly be termed a safety appliance.

Having decided on the kind of regulator to be used, a descriptive circular should be obtained from the manufacturers, and studied until every point in connection with the appliance is clear, because it may arrive in the condition known to the trade as "knocked down," or, in other words, it will probably be taken apart as far as practical for convenience in packing, hence a general knowledge of its construction will be necessary in order to set it up. Having done this, the next thing is to install the regulator ready for service, and in order fully to cover this point the following suggestions are made and directions given. The first point to be decided is where the regulator shall be located. If there is a suitable place for it under the stack where the damper is placed, a rigid connection can be made by means of an iron rod forged flat at both ends with a hole bored in each. This location will usually bring the regulator in the boiler room where it might be covered with dust and ashes constantly, therefore it is better to put it in the engine room. An iron rod may be attached to the damper lever and carried in a horizontal direction to a point just above where the regulator is placed, then by the use of a bell crank lever the corner may be turned and another rod extended down to the regulator, thus giving a rigid connection that is not carried in a straight line. In this case, when the damper is in the middle of its travel the lever should be in a vertical position. As a general rule, a small wire cable or a chain to draw the damper in one direction and weights to carry it the opposite way is satisfactory in service.

Having decided on the proper location, fasten the brackets that are to hold the shelf in position firmly in place. Stout screws will be satisfactory if they are to go into a wooden partition. For a brick wall expansion bolts are frequently used, but it is better to drill holes entirely through the wall and use machine bolts, with a washer under each head. As only small holes are required, it is only a short job to drill them, and as machine bolts always have square heads they can be held from turning while putting on or taking off the nuts. The shelf is laid on these brackets and fastened, and the regulator is placed thereon and secured with screws.

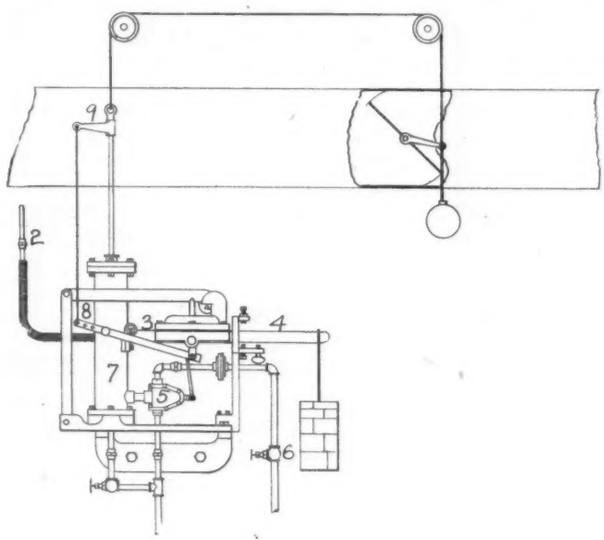
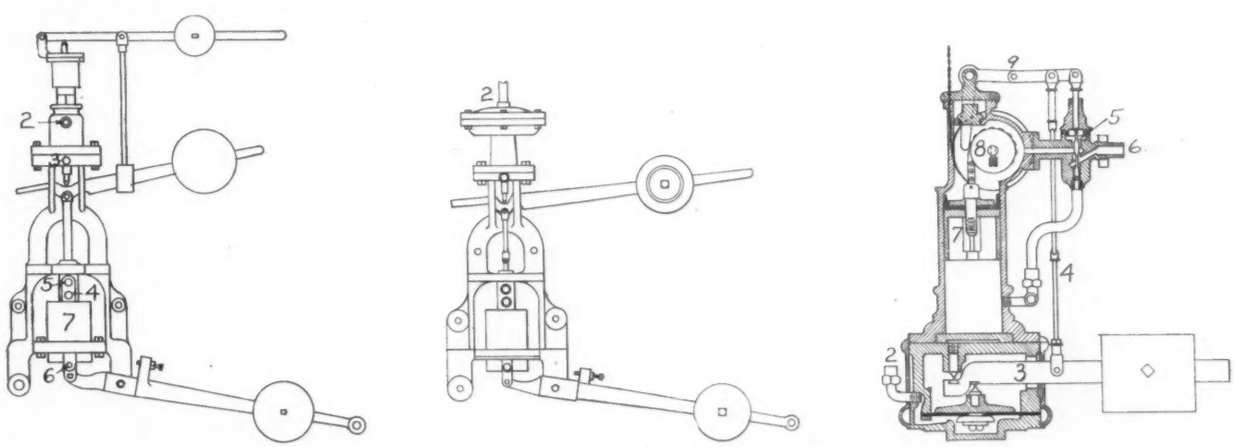


FIG. 3.—REGULATOR OPERATED BY WATER PRESSURE.

If the regulator is to be operated with steam, the supply should be taken from a pipe on which pressure is always carried (except when repairs are in progress, or on some similar occasion), and from which dry steam can be secured. If only a rubber diaphragm is to be operated, pressure may be secured from a steam or a water pipe under full boiler pressure, as either will answer the purpose. Connect the small pipe used into the proper place for it on the regulator.

If water under pressure is to be taken from an elevated tank or the street main, the proper connections should be made, as shown in the illustrated circular, and the appliance is then ready for use.



FIGS. 1, 2 AND 4.—AUTOMATIC DAMPER REGULATORS.

LETTERS ON PRACTICAL SUBJECTS

THE INSTALLATION OF ARC LAMPS IN STRUCTURAL STEEL INDUSTRIAL BUILDINGS.

In large structural steel factory buildings it is usual to use arc lamps for illuminating the interior, since these are most efficient for lighting such structures, and oftentimes the installation of such lamps presents some difficulties. Such at least was the case with the installation under consideration and the methods used for fastening and feeding the lamps may be of interest. The characteristics of the construction of the building are shown in Fig. 1. The roof trusses are of structural steel of the design indicated. The bottom truss chord is composed of two channels held apart about ⅜ in. by gusset plates. Steel columns support the trusses and brick walls, in which the window frames are set, form the sides of the structure. The most feasible plan of illumination made necessary a row of arc lamps extending from one end of the building to the other, a lamp being located in the center of each bay, offset a small distance from the longitudinal center line of the shop. The arrangement of the manufacturing equipment—each bay being occupied by a manufacturing unit—is such that it was not practicable to hang the lamps at trusses. The process of manufacture developed considerable dust and corrosive fumes, so that it was imperative, past experience being the criterion, that the conductors, carrying electricity to the lamps, should be enclosed in iron conduit. "Section AA" in Fig. 1 shows how the situation was handled. Wrought iron conduit of ½-in. nominal inside diameter, was carried, on the truss cords, the entire length of the building and was secured to the cords by means of the U-bolt, shown in detail in Fig. 3. The U-bolts were made of ¼-in. round, wrought iron rod, which was cut to the proper length, threaded and then bent cold, into the U shape.

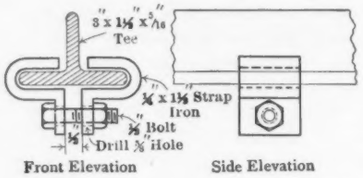


FIG. 4.—DETAILS OF CLAMP FOR TEE PURLINS.

Commercial, punched, wrought-iron washers and hexagonal nuts provided means for clamping.

At the point of suspension of each lamp, the arrangement shown in detail in Fig. 2 was prepared. Ordinary pressed steel outlet boxes were used, together with the regulation conduit lock nuts and bushings. The chandelier hooks and chandelier loops were purchased from a dealer in gas fitters' supplies, by whom they were regularly carried in stock. To carry the dead weight of the arc lamps, galvanized-iron chains, such as those used for the support of street lamps, but smaller, were used. One end of a chain was passed through a chandelier loop and made fast with a short length of No. 12 B. & S. gage soft brass wire and the other end, after having been passed over the bolt in the tee-purlin clamp (shown in detail in Fig. 4) and adjusted to the proper length, was made fast by the same means. In attaching the clamps to the tee-purlins, carrying the terra-cotta tile, forming the roof, it was necessary to chip out a bit of the tile in order to get a grip. The cover of the upper outlet box, lettered *A* in Fig. 2, was merely a plate of sheet steel, while that of box *B* was provided with a hole at its center, bushed with hard rubber, through which the conductors to the arc lamp were carried. The only conductor not protected by conduit was the short length between the bushing in the outlet box *B* and the arc lamp terminals.

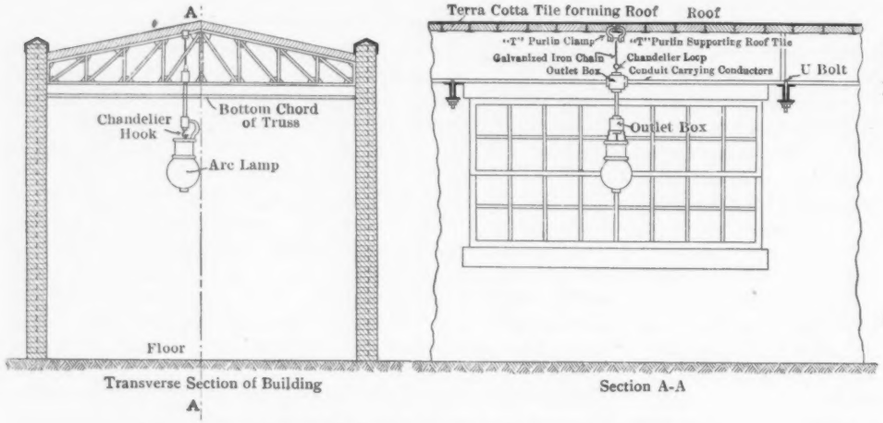


FIG. 1.—METHOD OF WIRING FOR AND SUPPORTING ARC LAMPS.

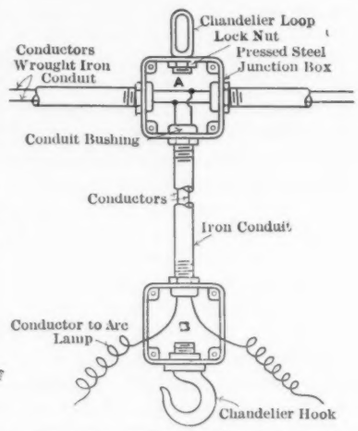


FIG. 2.—DETAILS OF FITTINGS ON OUTLET BOXES.

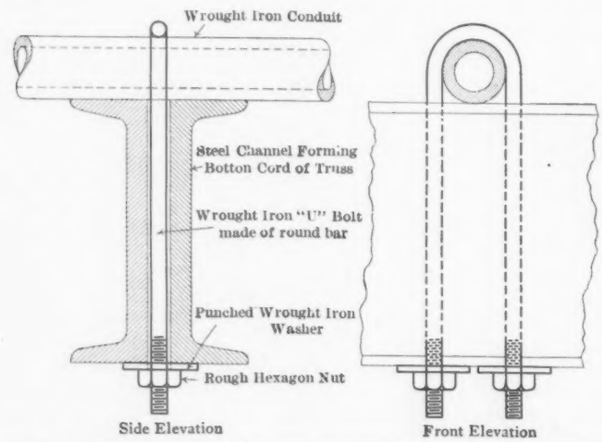

Wrought Iron Conduit
Steel Channel Forming Botton Cord of Truss
Wrought Iron "U" Bolt made of round bar
Punched Wrought Iron Washer
Rough Hexagon Nut
Side Elevation
Front Elevation

FIG. 3.—DETAILS OF U-BOLT FOR FASTENING CONDUIT TO TRUSS CHORDS.

Bridgeport, Conn. R. Tercroft.

ENGINE AND GENERATOR FOUNDATIONS.

I have read with a great deal of interest the letter in the May number in which the writer seeks to discredit the practice followed by some designing engineers in laying out engine and generator foundations of concrete. In this connection it might be of interest to your readers to know that I recently gave an expert every facility for putting in foundations as outlined by the writer of the article in the May number and the result was trouble, delay and a mislocation of 4 in. in height. No doubt had extreme care been taken in pouring the concrete into the molds and in making certain that each of the three molds re-

quired was accurately placed and filled the results might not have been so bad. Besides, experts are not always employed in pouring concrete into foundations. However, the facts do not warrant the criticism. The methods of draughtsmen are well founded and a great deal depends upon them and designers; more in fact than is generally supposed.

CHICAGO, ILL. C. H. B. SCHAEFER.

THE BOILER-FEEDING PROBLEM.

Of all the problems with which the engineer has to contend probably that of boiler feeding is the worst. To be sure, the forcing of water into a steam boiler has settled down to the use of one or two of a few devices, namely, the steam pump, the belted pump and the injector, of which there are several types employing either boiler steam or exhaust steam. No matter in what light the boiler-feeding problem may be considered, there is a considerable waste of energy in forcing the feed water into the boiler. For the purpose of illustration, let it be assumed that a boiler is to be fed against 150 lb. gage pressure and that the boiler requires 20 lb. of water an hour for 1 hp or 2000 lb. of water an hour for 100 hp. As a cubic foot of water weighs about 62.5 lb., the weight of an inch column of water 1 ft. high will be $62.5 \div 144 = 0.434$ lb. To permit the water to flow by gravity into the boiler under 150 lb. pressure there would needs be a head of water of $150 \div 0.434 = 345$ ft. The work of feeding the boiler would then be equivalent to raising 2000 lb. to a height of 345 ft. or $2000 \times 345 \div 60 = 11{,}500$ foot-pounds per minute.

The work the boiler is capable of performing, i. e., 100 hp, must equal $100 \times 33{,}000 = 3{,}330{,}000$ foot-pounds. The useful work performed by the boiler, less the amount absorbed by feeding, would then equal $3{,}330{,}000 - 11{,}500 = 3{,}318{,}500$ foot-pounds. The percentage of work necessary for boiler feeding would then be $11{,}500 \div 3{,}320{,}870 = 0.0034$, or 34/100 of 1 per cent—a little more than one-third of 1 per cent of the total boiler power.

According to theory, it does not require much power to feed a boiler, but the figures thus obtained do not include any allowance for friction, leakage or any of the numerous sources of loss between pump and boiler.

A boiler developing 100 hp an hour must set forth $33{,}000 \times 60 \times 100 = 33{,}000{,}000$ foot-pounds of energy, and taking 0.0034 of that amount the boiler feeding is found to call for the use of 112,000 foot-pounds of energy or $112{,}200 \div 33{,}000 = 3.4$ hp-hours for feeding the 100-hp boiler.

Taking the assumed steam consumption of 20 lb. of water to the horse-power hour, the boiler feeding should require $20 \times 3.4 = 68$ lb. of water an hour. To put the matter in another form, if the boiler is evaporating 2000 lb. of water an hour, it will require 68 lb. of steam an hour to feed the boiler, supposing or assuming that there was no mechanical loss in the pump, no heat loss in the boiler or engine, and that every heat unit liberated from the coal did its full duty in the boiler. But this never can be the case. There is loss all along the line.

The assumption made of 20 lb. of water an hour for each horse-power is, to be sure, one-third less than the A. S. M. E. standard of 30 lb., but there are records of only 8.66 lb. of steam per hp-hour, with a coal consumption of 1.04 lb. It is assumed that 20 lb. of steam an hour may be taken as a safe theoretical quantity for average engine consumption in calculating the value of various feed-water appliances. Thus, it is figured that it requires 56 lb. of steam actually to feed a 100-hp boiler with no allowance for loss of any kind whatever. But there are many losses. It is stated by Mr. Charles E. Emery that the average sizes of direct-acting steam pumps do not utilize more than 50 per cent of the indicated power of their steam cylinders, and that their duty is only about 15,000,000 foot-pounds to 100 lb. of coal. This, he states, is equivalent to a steam consumption of 120 lb. of steam to the hp-hour. Prof. D. S. Jacobus states that the direct-acting pump, when feeding boilers, has a duty of 10,000,000 foot-pounds to 100 lb. of coal; this is equivalent to about 180 lb. of steam to the hp-hour. In Gilbreth's "Field Book" the statement is made that the various boiler-feeding devices require a coal consumption as follows:

Pump.	Coal per hp-hour.	Steam per hp-hour.
Small steam pump	25	200
Iuspirator or injector	100	800
Centrifugal pump, belt or direct	5 to 10	40 to 80
Triplex pump, belted or geared	2 to 4	16 to 32

The steam quantities were calculated by the writer upon the evaporative rate of 8 lb. of water to the pound of coal. These quantities are not given in the field book, and the duty of the indicator strikes the reader as a misprint, and it seems as though it should be 100 lb. of water or steam to the horse-power instead of 100 lb. of coal; but 800 is about right, as will be shown later.

It will be seen that the belted pump is the most efficient boiler-feeding appliances, and yet not one small or medium-sized power plant out of four uses a power pump for feeding the boiler. The small, direct-acting steam pump is always in evidence, and together with an inspirator usually constitutes the boiler-feeding apparatus, the efficient power pump being conspicuous by its absence. It is evident that there should be more power pumps used for boiler feeding, and the central-station manager who is always looking around after methods of reducing operating expenses will find a chance to reduce expenses a little by installing and using electrically-driven boiler-feed pumps.

Referring to Gilbreth's table again, it is shown that with the power pump, the boiler may be fed with 16 lb. to 32 lb. of water to the horse-power. The amount of water used depends entirely upon the efficiency of the engine and the amount of steam consumed per hp-hour is, of course, the same as that of the engine which drives the pump. In the case of the Swedish engine referred to above, the power pump will require but 8.66 lb. of steam, against 200, more or less, for the direct-acting steam pump.

The injector undoubtedly has a very low efficiency when considered merely as a pump, its duty, according to Prof. R. C. Carpenter, ranging from 161,000 to 2,752,000 foot-pounds to 100 lb. of coal. The same authority gives the duty of small boiler-feed steam pumps as between 4,000,000 and 8,000,000 foot-pounds, while he states that the best pumping engines show a duty of 100,000,000 to 140,000,000 foot-pounds. If the duty of the small steam pump ranges from 4,000,000 to 10,000,000 foot-pounds, it may be assumed that the average duplex boiler-feed pump has a duty of about 7,000,000 foot-pounds. Taking the average duty of the injector as $\frac{161{,}000 + 2{,}752{,}000}{2} = 1{,}456{,}500$ foot-pounds, or 1,500,000 lb., to use a round number; it approximates a consumption of about 1200 lb. water to the hp-hour, so that the value given in Gilbreth's field book is a conservative estimate of good injector practice. The injector is, according to these figures, the worst boiler-feeding device that can possibly be used. No wonder that the steam pressure drops when the injector is started and no wonder that when an engine is suddenly shut down with a heavy fire under the boiler the engineer or fireman always starts the injector and thus reduces the steam pressure so quickly that the pop valve seldom gets a chance to work. Luckily, there is one feature about the injector which makes it a useful device. Its thermal efficiency is almost 100 per cent, and almost all the heat contained in the steam used is returned to the boiler with the water pumped in. Were it not for this peculiarity the injector would not be used. Even the loss in the injector due to friction reappears as heat, which is carried into the boiler, and the heat which is converted into the useful work of forcing water against boiler pressure in the injector appears in the boiler as stored-up energy. The injector, then, which is the most wasteful pump in existence as far as efficiency is concerned, has earned a permanent position among steam appliances because of the fact that it wastes nothing in the heat line.

The steam pump is fairly efficient in one direction, but it wastes heat and so stands at the head of wasteful appliances in the conservation of energy. The power pump wastes the least of all the water-movers. The injector occupies the very

peculiar position of having almost no efficiency at all, yet so saving is it of heat that it has earned for itself a place as a boiler feeder when there is no engine running to furnish exhaust for steam heating for feed water. When a heater can be used, there is no inducement to use the injector, not even with the discharge to the boiler through the heater, for the reason that most injectors heat the feed water to 175 deg. or to 180 deg. and by a proper adjustment some injectors can be made to deliver water above 212 deg.

The higher the pressure in the boiler the less water to the pound of steam will be forced into the boiler by an injector. When 30 lb. of water can be forced by 1 lb. of steam at a gage pressure of 10 lb., not more than 11 lb. of water is forced by the pound of steam at 80 lb. gage pressure. At pressures of 100 lb. to 150 lb. hardly 9 lb. or 10 lb. of water will be forced into the boiler to each pound of steam consumed or condensed in the injector. This means that at 9 to 1 a boiler using 2000 lb. of water an hour must needs condense about 222 lb. of steam, or 12½ per cent of the available steam power of the boiler. What a handicap the locomotive boiler labors under when forcing feed water against a pressure of 160 lb. or 200 lb. of steam! Probably not more than 6 lb. or 8 lb. of water to the pound of steam used is forced into the boiler.

The centrifugal pump is at the present time being considered to some extent for boiler feeding. "Series" centrifugal pumps are now made by means of which almost any pressure may be obtained. These pumps are sometimes designated as "three-stage," "four-stage," "two-stage" pumps, etc., according to the number of pumping stages used in obtaining the required pressure. Gilbreth's field book gives the centrifugal pump 5 lb. to 10 lb. of coal an hour, or about two-fifths the efficiency of the belted pump. In other words, the centrifugal, single-stage pump will use two and one-half times as much steam an hour as the belt-driven pump. Still, this is from two and one-half to five times as economical as the steam pump. Some interesting facts on the centrifugal pump were given by Mr. E. N. Percy in the June number. The development of the multi-stage and the turbine-centrifugal pump has probably caused them to approach much closer the efficiency of the engine-driven reciprocating pump. The great source of loss in the centrifugal pump when used for boiler-feeding purposes must be in the friction of the water along the blades or vanes. Like the screw-propeller wheel, the greatest loss is in the slip and in the skin friction of the water over the surfaces of the vanes. The greater the pressure against which water must be forced, the greater the skin friction and the less the efficiency of the machine.

The absence of the proper data prevents comparison being made between up-to-date multi-stage centrifugal feed pumps and the engine-driven pump, and such comparisons would be valuable to readers. A point brought forward by Mr. Percy is that with all the checks wide open or tightly closed there will be little variation in the reading of pressure gages attached to the feed pipe. This is no doubt the case as a certain number of revolutions of the rotor will raise water to a certain height in a vertical pipe and hold the water at that level as long as the stated speed is maintained. But what is of great interest to the boiler owner is: What will be the amount of power required when the water is held at a given pressure without any flow, and what power is required when there is a flow of water into the boiler under or against the stated pressure? How much more work is being done when the pump is feeding 2000 lb. of water an hour into a boiler against 150 lb. steam pressure, than when the valve is closed in the feed pipe and the runner is churning the same water around and around in the pump-case, the same pressure being maintained, but no water flowing? It has been the experience of the writer, with some makes of centrifugal pumps, that the belt cannot be kept on the pulley when the delivery valve is closed, but that does not answer the question. The writer would like to see the merits of the centrifugal boiler-feed pump fully discussed in these columns.

Willoughby, Ohio. James F. Hobart.

CREOSOTED WOOD FOR CONDUITS.

The recent meeting of the so-called House of Governors, and its avowed purpose of the conservation of our natural resources, has greatly stimulated discussion and experiment in those fields of industry wherein the utilization of many such resources has proved a considerable drain. And in none has more energy been shown and more discussion aroused than concerning wood and the forests. The pulp industry, for paper making, house construction, railroad ties, and even so small a thing as a lead pencil, have each required in the aggregate an enormous cubical bulk of this important natural resource, to the detriment of the climatic conditions in many parts of the North and Northwest, the deforesting of many sections of the trans-Mississippi country, as well as the Northeast and consequent enormous losses by freshets and erosion. The creation of forest reserves and the ever-increasing activities of the Bureau of Forestry have but proved a stop-gap so far.

The present annual cut of lumber approximates 40,000,000,000 feet (board measure), and the total annual mill value of lumber, lath and shingles is not less than $700,000,000, according to recent statistics. Yellow pine, as a lumber producer, ranks first, with Douglas fir, white pine, hemlock, oak and spruce following in the order named. Among the states, Washington

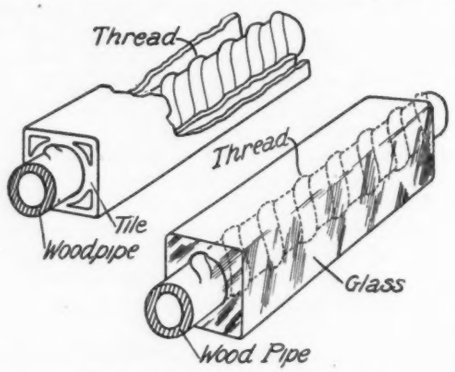


FIG. 1.—CREOSOTED WOOD CONDUIT.

ranks first, Louisiana second, Wisconsin third, Michigan fourth, Mississippi fifth, and Arkansas sixth in its production. In 1906, according to census figures, Washington produced 4,305,053,000 ft. These figures give some indication of the tremendous inroads that one industry alone (lumbering) has made upon our visible supply of forest timber.

In a study of the best material available for various purposes of building and manufacture, as well as for power, those in which wood is an absolute necessity, must first be considered and its use curtailed or abandoned where other material of lesser importance may be substituted.

In the transmission of energy through wire and cable, wood treated in various ways for preservation has been found to be of great utility, since it is a non-conductor, and has the merit of being easily worked, can be chemically treated and lasts many years. Its use for water pipes and conduits is quite ancient, and many American cities early used it for their water supply. I have seen a section of one of the earliest water pipes used in New York exhibited in the little office which Aaron Burr used when he practised law here. It was of red cedar, and in spite of its age (over 80 years), was still sound and good, of cylindrical bore, but outer octagonal form, and jointed in mortise and tenon fashion. A pipe somewhat similar is in use to-day.

It was found of greater utility to coat wood chemically for its greater preservation, used both for piping and for conduits, and many processes have been employed, notably sulphates of copper and iron, carbonate of soda, chloride of zinc and creosote or dead oil of coal tar. The latter process, invented by Bethell in 1838, gives the best results, and has been widely used here and abroad for wood piping, wooden railroad ties, wood paving blocks and piles, as well as poles. The method of treating the wood is to run cars loaded with the wood into

large steel cylinders 6 ft. and over in diameter, close the heavy iron doors, and then subject the timber to live boiler steam at 225 deg. to 250 deg. Fahr., until thoroughly heated through, then drying it and condensing the albumen in the sap. Air and steam are then exhausted by a vacuum pump which extracts all the sap at a vacuum of 26 in., the same evaporating at about 130 deg. Fahr. The process of seasoning the timber is thus continued until all the sap is extracted, when creosote at a temperature from 100 deg. to 125 deg. Fahr. is pumped into the cylinder and the required amount of oil forced into the timber under pressure. The quantity so added to the wood is accurately measured, and varies from 8 to 20 lb. of oil for each cubic foot treated.

The value of creosote over the other processes mentioned consists in its staying longer in the wood because it more

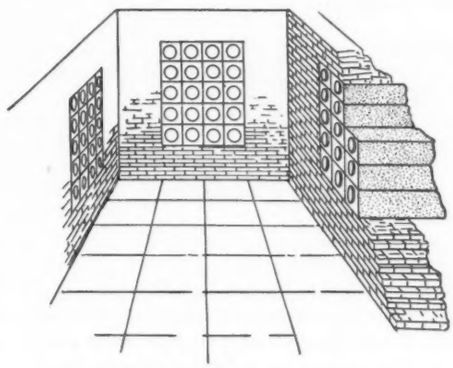


FIG. 2.—SECTION OF MANHOLE.

thoroughly permeates it. This depends upon the thoroughness of the previous steam drying, and has been practised over 50 years. It is costlier than the other methods in common use; the chloride of zinc or Burnett process, and the Wellhouse or zinc-tannin process, in which a small amount of glue and tannin is added to the zinc chloride. According to a recent writer, the proportionate cost is as 50 for creosote to 12 for the Wellhouse and 10 for the Burnett, while the durability is as 18 years to 14 years to 10 years in the same order, with considerable advantage in the latter quality in favor of the latter or Bethell creosote process for many uses.

In electrical conduits, the use of which are so enormously important and extensively growing, I would suggest a variation in the treatment of the wood by using some filler which combines with the oil, giving the same protection but lessening the cost. A process similar to the one I have in mind is the Chanute zinc creosote process, used for a number of years in Germany rather extensively, in which an emulsion of the zinc chloride and dead oil of coal tar in the proportion of ½ lb. of pure chloride to 4½ lb. of the heavier oil. It is said that this combination gives a much greater life to the wood so treated, and almost treble durability is secured in red oak for example.

To make a pipe with economical use of the creosoted wood I would suggest the pipe or conduit itself be cylindrical and have a rough spiral or thread moulded on the outside enabling it to be screwed into a vitrified tile or thick glass jacket of square form. Hollow tile of the forms and sizes now made could be readily adapted to this innovation with little change of machinery or plant conditions. To make the pipe last as long as solid block pipe, its cylindrical depth would have to be somewhat increased, as well as to allow for the thread or groove to be molded on it, but this would not add appreciably to the cost of manufacture or maintenance. Several miles of streets in the Borough of Brooklyn, and also in cities of the West, notably Pittsburg, have wire and cable conduits composed of such units, which were first so used about 1884. They are favored for another quality in protecting from the effects of frost and cold, being non-conductors. Gas and service mains can thus be protected. The cables of wiring systems are kept from decay and detrioration by such a process.

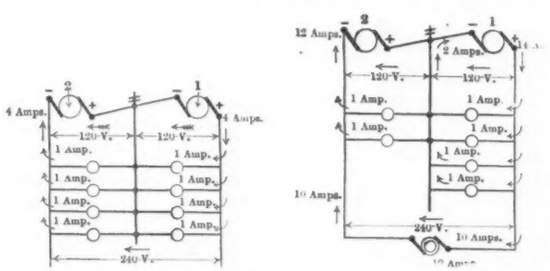
NEW YORK. F. W. MOORE.

THE PRACTICAL OPERATION OF THE THREE-WIRE SYSTEM.

The three-wire system, as originally evolved, was designed to supply electricity to 120-volt lamps and 240-volt motors with a minimum variation of line pressure due to the starting in-rush of current to the motors, when started, and is, probably, the ideal system for congested districts. As first installed, the system consisted of a pair of bipolar generators connected as shown in Fig. 1, to the three copper conductors, consisting of a positive lead, a negative lead and a center lead, called a neutral lead. The current flows from the positive side of generator No. 1 through the connected lamps, thence through the lamps on the other side of the system and back to the negative side of generator No. 2, thus working in a circuit consisting of the two generators and the connected lamps; if, however, a greater number of lamps is connected to one side of the system than to the other, then, instead of the entire output of the machines flowing through a circuit consisting of the lamps and positive and negative leads, a certain proportion depending upon the amount of unbalance on one side or the other of the system, is sent out from one machine or returned to the other machine by way of the neutral lead, as illustrated in Fig. 2, thus providing two separate circuits for the lamps and maintaining a uniform voltage between the two outside or motor leads.

With a balanced load, such as illustrated in Fig. 1, the neutral lead might be disconnected without affecting the system, but with an unbalanced load, as illustrated in Fig. 2, a disturbance of the voltage relations of the two sides of the system would result as the current flow between conductors is in proportion to the resistance of one connecting path divided by the number of paths, provided they are of a uniform resistance, as would be the case if, as illustrated, and therefore as the positive side was consuming 4 amp and the negative side but 2 amp, it is obvious that with the neutral lead opened, that the drop of potential will be less between the positive lead and the neutral, than between the neutral and negative leads with the natural result that the lamps on the positive side will burn dimly, and the lamps on the negative side burn brightly until the neutral connection is restored.

The neutral lead is usually grounded, so that a ground on either of the outside leads will blow a fuse, thus cutting out but half of the lamps, whereas, if the neutral lead was not grounded, an outside lead might remain grounded until a similar ground came on the other outside lead, which would blow both outside fuses and cut out all the lamps, in addition to creating a much more severe blowout by reason of the



FIGS. 1 AND 2.—BALANCED AND UNBALANCED THREE-WIRE SYSTEM.

blowout taking place under a pressure of 240 volts instead of 120 volts, as would be the case with a grounded neutral.

Given the three leads, as illustrated, with lamps connected across the two sides, a 240-volt motor may be connected across the two outside leads and operated with but slight effect on the lighting leads, the counter e.m.f. of the motor forming a practical resistance to the passage of a certain amount of current as the actual resistance of the lamps does, with this difference, in the case of the lamps the electrical energy is transformed into light, and in the case of the motor, it is transformed into mechanical motion.

The neutral lead may, of course, be opened without effecting the motor as it is connected across the two outside leads and operated on a 240-volt circuit, regardless of the conditions of balance or unbalance of the lighting circuits. A ground on

either of the two outside leads will create a short circuit on the generator connected to that side, which should be cleared from the switchboard, if the short circuit remains on any length of time. Where shunt wound machines are used, a severe short-circuit may reverse the fields, that is, when the machines are excited to pick up the load after the trouble has been cleared, it may be found that what was formerly the positive machine has become the negative machine, and vice versa; a condition that may be remedied by exciting the fields from an outside source through a lamp bank or from several batteries connected in series; care being used to pass the exciting current through the field windings in a direction the reverse of that which it followed when supplied by the machine; in other words, to correct a reversed field, connect the negative lead of the field winding to a positive source of exciting current, thus placing the field winding of the machine in series with the source of exciting current.

Another fault which sometimes is found in shunt machines, consists of failure of the machine to build up when brought up to speed, caused by the field circuit having been broken too soon and too quickly after the machine has been disconnected from the busbars after its previous run, thus discharging the field magnets and upsetting their residual magnetism. They may be charged in the same manner as in the case of reversed fields, with this precaution, that the negative or positive source of excitation must be connected to a similar polarity of the field winding instead of in reverse, as in the first case.

With a balanced load, the position of the brushes will be about the same on each machine, but with an unbalanced load, one machine will, of course, carry more load than the other, and the neutral point of the magnetic flux, cut by the armature windings, will be further forward in the direction of rotation, and therefore the sparkless running point of the brushes on that particular machine will be further forward than on the lighter loaded machine.

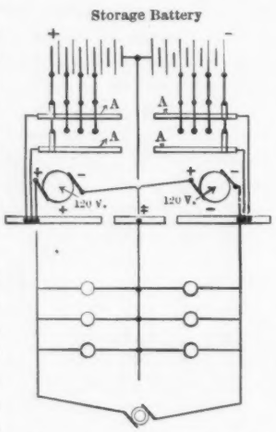


FIG. 3.—BATTERY ON THREE-WIRE SYSTEM.

Where more than one set of generators is used, they are operated in multiple on suitable busbars, thus rendering it necessary when a second set of generators is to be cut in on the system, to balance the voltage between the busbars and each of the outside leads of the set to be switched in, before the switches are closed, by varying the excitation of the second set until a reading of zero is obtained on the balancing voltmeter. If there should be a difference of three or four volts, it should be in favor of the machines going on that they may pick up a little load as soon as the switches are closed, and thus tend to steady the engine.

With the development of the storage battery it was recognized that a storage battery equipment would be a valuable reserve on a three-wire system, and such equipments are now in general use, connected to the station busbars, as shown in Fig. 3. The sliding switches *AA*, usually termed "top" and "bottom" sliders, provide a double feed from each side of the battery to the busbars, thus permitting the battery to be "floating," or discharging on two sets of busbars of different e.m.f.'s at the same time, and also facilitate the separate charging of the "end cells." The elements of the storage battery are the lead plates, the electrolyte and the tank containing the first two elements. Their operation on lighting systems consists of full discharge in emergency, partial discharge on the peak of the load and irregular discharge at various times.

As it is necessary to keep an accurate record of the condition of a battery, a recording voltmeter is usually connected between the neutral tap and cell No. 50, on each side of the battery, thus recording any variation of the voltage of the 50 cells mentioned, and thereby indicating the extent and duration of each charge and discharge, as well as the momentary charging and discharging, which takes place if the bus pressure varies and the battery is not properly regulated to conform to those changes.

The following table shows the different number of cells required for properly floating a battery at different bus voltages, as adopted by several lighting companies:

No. Cells.	Bus Voltage.
56	115.4 to 117.4
57	117.4 to 119.5
58	119.5 to 121.6
59	121.6 to 123.7
60	123.7 to 125.8
61	125.8 to 127.8
62	127.8 to 129.9
63	129.9 to 131.9
64	131.9 to 134.0
65	134.0 to 136.1
66	136.1 to 138.1

In addition to the chart record it has been found necessary to keep a book record of the number of ampere hours charge and discharge, so that the operator might have a ready reference as to the standing of the battery under his charge, at any time where the battery is used on the peak of the load, and for irregular discharges, thus giving an approximate idea of the amount of ampere hours in the battery, and to go back into it to bring it to a full charge.

If recording voltmeters are not used, the appearance of the cells will indicate when a battery is fully charged by a pearl gray appearance of the electrolyte, which boils freely and flows from the center toward the ends of the cell, the gas bubbles of which will, if ignited by a match, explode with a sharp, resonant report, but this method is not as accurate as the chart method which indicates by a rising curve the progress and uniformity of the charging rate, which flattens into a straight line when the battery is fully charged.

It is obvious that where two generators are used one side of the battery may be charged or discharged independent of the other, with the aid of an auxiliary piece of apparatus called a booster, which is installed with the battery equipment, as the maximum charging voltage of a battery of 75 cells per side, the usual installation, is much higher than that of the generators, and which consists of two 60-volt dynamos, direct connected to a motor and electrically connected in series with the charging generator and the battery, thus impressing any part of their e.m.f. in addition to the generator e.m.f., to the charging circuit.

As a booster is always in series with the source of supply, it is evident that the positive lead of the booster generator in use on the negative side of the system should be connected to the negative busbars, and the negative lead of the positive machine to the positive busbars. The leads of a booster, which are commonly connected to the source of supply, are usually called the "low legs," and the leads which are connected to the battery to be charged or feeder to be boosted, the "high-legs"; reversing switches are sometimes installed in the field circuits of the booster generators, so that the direction of boost may be reversed if operating conditions should ever require it.

A three-wire, two-generator outfit may be operated in conjunction with a battery with one of the generators disabled by cutting in sufficient cells on the side of the system to which the disabled generator is usually connected, thereby placing that machine's load on the battery, and that side of the battery may be recharged at a period of light load by running extra machines on the busbars and utilizing the excess capacity of that side of the system for charging the battery.

The booster may be used to "crush" as well as "boost," if reversing switches are installed in the booster generator field circuits, by throwing over the reversing switches, thereby opposing the e.m.f. of the booster generators to that of the busbars to which the "low legs" are connected, thus reducing instead of "boosting" the outgoing leads of the machine to any desired voltage within the range of the equipment.

Brooklyn, N. Y. W. F. Fernandez.

QUESTIONS AND ANSWERS

Much of our insulated overhead wire has become somewhat deteriorated by age and exposure; that is, the insulation is frayed. Can this be repaired cheaply or will it be necessary to take down the wire? R. M.

There was a device on the market at one time for painting wire with an insulating compound without removing the wire; but it would be best to remove the defective wire and substitute new wire in order to avoid damage suits and public criticism.

We have recently installed on our lines a synchronous motor which besides acting as a regulator drives a direct-current generator belted to it. The direct-current voltage however fluctuates noticeably. What is the reason for this behavior? E. C. N.

The results reported have been known to exist where the exciter is run from the synchronous motor shaft. If the exciter be belted to a separate motor run from a separate feed the fluctuations in voltage will probably disappear. The remedy suggested has been tried in similar instances with good results.

Why is it better to use a choke coil on alternating-current circuits than a rheostat? M. M.

A choke coil sets up a counter e.m.f. which opposes the line voltage and reduces the current. It also causes the current waves to lag behind the e.m.f. waves. The energy actually used is equal to the current times the component of the e.m.f. which is in the same phase. A rheostat reduces the current on a line by increasing its resistance and the energy absorbed by the resistor appears in the form of heat and is usually wasted. The choke coil does not waste much energy, but is only applicable on alternating-current circuits.

Is there an instrument on the market which will determine directly the approximate resistance of various pieces of electrical apparatus? R. B.

An ohmmeter can be used for this purpose. A fairly accurate instrument of this kind may be made from a voltmeter, an old one will answer, the scale of which is calibrated to read in ohms instead of volts. The calibration can be effected by using a Wheatstone bridge and plugging out the desired values of resistances to be calibrated. The resistor whose resistance is to be determined is placed in series with the instrument and the deflection of the needle is reduced by an amount proportional to the magnitude of the resistance.

I notice that in most of the power stations burning fuel smokelessly forced draft is used. The boilers in the stations referred to are hand fired. I have always been under the impression that excess of air was not desirable. What part does this excess play in burning fuel without smoke? D. E. M.

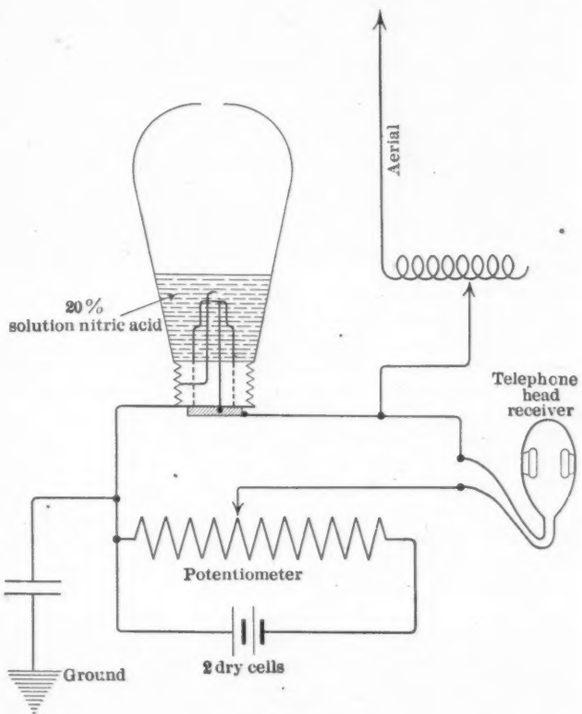
The stations noted are doubtless burning the cheap grades of anthracite coal. In these stations a good draft is required to burn the fuel, because, being very fine, it packs tightly and combustion would not be complete if a draft sufficient to pass air through this tightly packed bed of fuel were not used. The fuel burns without smoke as it is, and an excess of air is avoided by covering blow holes in the firebed with green fuel just as soon as they appear.

The idea that I have gained from text books is that the difference in phase of primary and secondary is theoretically 180 degrees. Please inform me if I am correct? C. P. W.

One frequently sees a statement that "the difference in phase of primary and secondary is, theoretically, 180 deg." This statement, without any modification, will convey no idea whatsoever, because no statement is made as to what the term "phase" may refer. It is correct, however, to say that a certain component of the primary current of a transformer is directly opposite in magnetomotive force to the secondary current. It is probable that many people would consider that the time phase of one of these currents is 180 deg. from that of the other. The active electromotive force generated in the secondary coil by the rate of change of the core flux is exactly equal to the counter-voltage similarly generated in the primary coil of a transformer. Thus, many writers assume that the secondary e.m.f. is opposite in time phase to the primary e.m.f. In making such a statement, however, a person should be careful to specify just what is meant by the term "phase."

At the Annapolis Naval Academy a small incandescent lamp is said to be used as a detector for a home-made wireless set. The interior of the lamp is filled with nitric acid to cover the platinum points of the leading-in wires and the device is used in connection with an ordinary telephone receiver. Will you be so kind as to state exactly how the incandescent lamp can be made to act as an efficient wireless telegraph receiver, showing connections, etc., and the auxiliary apparatus used? A. H. B.

The diagram of connections presented herewith has been kindly supplied to us by Lieut.-Com. W. H. G. Bullard, U. S. N. The platinum leading-in wires of the lamp are used as electrodes. That for the anode is filed off flush with the surface of the glass stopper and that for the cathode is bent over so as to approach the anode, but still kept a short distance from it. The other connections are self-explanatory.



We are operating an old Edison station which like others of its kind is located in the center of the town. The three-wire direct-current system has always served our purposes, but the growth of the town has been such as to make it unprofitable to run the three-wire system out to the newly-built-up district. This fact, coupled with the fact that our machinery was quite old, induced us to install new alternating-current machinery; the direct-current load being fed from motor-generator sets and all new business being connected to alternating-current circuits. We have succeeded in getting considerable lighting near the station which we desire to feed from alternating-current lines and as the load is light during the day we feel that perhaps the transformer losses would wipe out all saving due to the use of alternating current. Can such loss be avoided? T. S. C.

We recall a station operating under somewhat similar conditions in which a fair lighting load was supplied in the vicinity of the station by a number of transformers through three-wire overhead secondaries. All of the secondaries were incorporated into one system and supplied from transformers located in the station. During the day, when the load is light, only one transformer is used to supply the circuit with energy and when the load increases an additional transformer is cut into circuit. In this way small pole transformers are avoided and the core losses of the larger transformers are reduced to a minimum since the transformers are only cut into circuit when needed. A system such as this might possibly appeal to you.

Non-Peak Central-Station Load at Marion, Ind.

EVERY well-managed central-station company is looking for opportunities to profitably sell as many kw-hours per year as possible for each kilowatt of station capacity installed. To do this, it is necessary to keep the average load as high as possible with reference to the maximum load of the year, which determines the amount of generating apparatus in which the company must invest to carry on its business. The average load determines the output or kw-hours sold. The average load of the Marion Light & Heating Company's plant for 1907 was 43 per cent of the maximum load for the year; or, in other words, the load factor was 43 per cent. Central stations operating in towns of the size of Marion, which has a population of about 25,000, frequently have a yearly load factor no better than 25 per cent. It is, therefore, seen that the Marion company is doing something notable in the way of making its generating capacity earn money more hours per year than the ordinary station.

NON-PEAK POWER CONTRACTS.

The secret of the Marion company's success in this respect is to be found largely in the large number of power contracts which it has made with Marion manufacturers in which the company has the option of ordering the manufacturer to stop his motors during those hours of the year that the heaviest lighting load comes on the station. This is a class of power business commonly known as "non-peak," and has probably been developed in Marion more extensively than in any other town of its size in the United States, although at Montreal much development of this kind of power load has taken place. For years central-station men did not consider it feasible to make contracts with power consumers under which the consumer agrees to keep his load off during the central-station company's peak. The Marion company has demonstrated practically, however, that this is feasible under conditions at Marion, and that it doubtless is feasible in many other cities with certain classes of customers. The greater part of the power used in Marion is in medium-sized factories. If the power were subdivided among smaller consumers, the enforcement of the non-peak clause in the consumer's contract would not be so easy as it is. At Marion no difficulty has been encountered in enforcing the non-peak clause whenever the company has found it necessary to do so. It has not been the custom to enforce it when the company had sufficient reserve capacity to take care of power load during the peak. However, manufacturers have adjusted their hours of working to the non-peak clause of the contract, so that the daily station load curves show that there is no great tendency for these non-peak users to operate during the peak.

The clause in the power contracts which covers the non-peak feature reads as follows:

"That in consideration of the terms granted consumer by company in this contract and agreement, consumer agrees to shut off power during the hours named in the following schedule:

"From first day of October to fifteenth day of October—5:15 p. m. to 6:05 p. m.

"From sixteenth day of October to fifteenth day of November—5:00 p. m. to 6.05 p. m.

"From sixteenth day of November to tenth day of December—4:45 p. m. to 6:05 p. m.

"From eleventh day of December to first day of January—4:30 p. m. to 6:05 p. m.

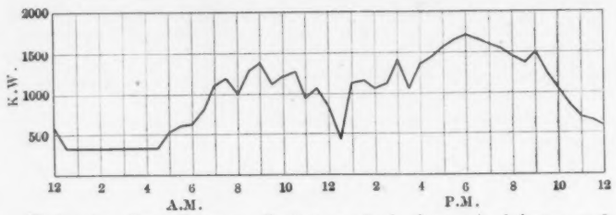
"From second day of January to first day of February—4:45 p. m. to 6:05 p. m.

"From second day of February to March first—5:15 p. m. to 6:05 p. m."

About 800 hp out of a total of 2000 connected have this non-peak clause in the contracts. The company has not been in a position where it has been obliged to enforce this clause as regards the smaller miscellaneous motors, although it has enforced it when necessary in the case of the larger motors.

In order fully to understand the power situation at Marion, it is necessary to go back a few years in the history of the central-station business there. A vigorous campaign for motor business was begun in 1904. At that time the supply of natural gas, which had been extensively used for fuel, was rapidly on the decline and the numerous manufacturers who had come to Marion were anxious for some other form of cheap power which would be as clean or cleaner than natural gas. The company was completing a new economical power station, and consequently was able to make these manufacturers propositions which were attractive.

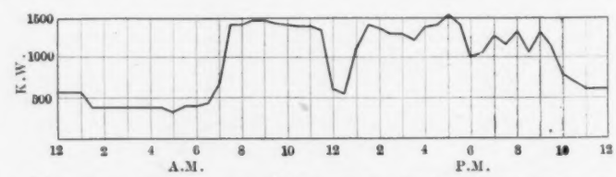
About 30 per cent of the motors connected were originally put in on trial by the company. As a result of the policy as to rates and methods of going after this business about 90 per cent of the total power used in the town now is supplied by the company. The connected motor load is about 2000 hp, distributed among 100 customers. The average revenue from motors connected in 1907 was $20 per horse-power.



Wednesday, Dec. 18, 1907. Output, 21,185 kw-hours; load factor, 51.8 per cent; coal per kw-hour, 6.4 lb.

FIG. 1.—DECEMBER LOAD CURVE.

The power rates are very low in consideration of the non-peak clause in the contract being 3.5 cents per kw-hour for motors on meter. However, a considerable number of all-day users have been taken at a flat rate of $35 per horse-power per year, a rate of $45 being given all-day and all-night users. While this flat rate may in some cases be more than that which the consumer will pay if placed on a meter, and it is always fully as much as he would pay on a meter basis, the company has been able to close with some consumers on flat rate rather than on the meter basis because of the uncertainty which the consumer felt at the outset as to what his bills would be on a meter basis. Under such flat rate contracts the company cannot lose, and the consumer is satisfied and easier to get than on a meter basis. Of course, such contracts are mainly attractive to the consumer who uses power many hours per day, and it is only with such consumers that the company could safely make a flat rate which would be low enough to get the business.



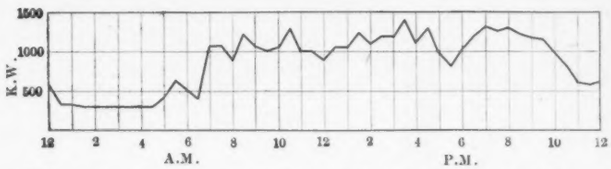
Wednesday, June 6, 1907. Output, 20,990 kw-hours; load factor, 56 per cent; coal per kw-hour, 5.1 lb.

FIG. 2.—A JUNE LOAD CURVE.

The effect of securing power contracts in this way is best illustrated by some typical daily load curves taken from the power station records. The curve of most interest in this connection is one from a December day, such as that shown in Fig. 1, for December 18, 1907. This is notable for the absence of the sharp peak between 5 and 6 p. m., which is characteristic of most central-station load curves. The peak, which is fairly broad, reaches its maximum at 6 p. m. with a load of 1700 kw. The day power load before evening lighting comes on reaches 1400 kw. The average load is 51.8 per cent of the maximum. Fig. 2 shows the load curve for June 19, 1907, in which there is nothing that could be called a peak, unless it be the entire morning and afternoon loads. Fig. 3 is a load curve for

March 20, 1908, in which the highest load happened to occur at 3:30 p. m. Fig. 4 is another load curve chosen from the records to show an unusually high load factor of 69.5 per cent. This, however, can hardly be called typical, as the daily load factor is seldom that high. From these load curves it is evident what an important bearing non-peak power contracts have on the output which may be obtained from a station. It also has a very important bearing on station economy, as seen from the notations of coal consumed per kw-hour on the various load curves. Coal per kw-hour runs from 5.1 lb. in summer when the station is operating entirely condensing, to 7.7 lb. when the station is supplying the hot water heating system. This is with cheap $1.25 Illinois screenings.

The station is equipped with water-tube boilers and four 500-kw Curtis turbines. In summer it is run entirely condensing. In the coldest weather in winter steam for heating water for the heating system is taken from between the first and second



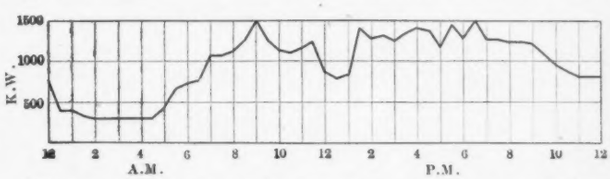
Friday, March 20, 1908. Output, 18,614 kw-hours; load factor 55 per cent; coal per kw-hour, 7.7 lb.

FIG. 3.—A MARCH LOAD CURVE.

stages of the turbine. In the mildest weather the exhaust steam from the condenser pumps, feed-water pumps and step-bearing pumps is sufficient to supply the heating system. About 120,000 sq. ft. of radiation is connected, the rate for this being 20 cents per square foot per season. The Evans Almirall hot-water heating system is used.

The operation of this plant is a striking illustration of the fact that a company can afford to take non-peak power users at a very low rate because of the economies of production which the presence of those non-peak users makes possible. The average coal consumption for the year is 6.6 lb. per kw-hour.

Although much has been said about non-peak power, because this has such an important bearing on the general economy of operation and ability to make money at low power rates, the company has also been very progressive in lighting matters and has secured an amount of outline and sign lighting around the public square which has earned for Marion the name "Electric City of Indiana." This name has become so well known that



Output, 21,365 kw-hours; load factor, 69.5 per cent; coal per kw-hour 6.2 lb.

FIG. 4.—LOAD CURVE OF MARION STATION.

a postal card addressed recently to the superintendent of the lighting company, "Electric City, Ind.," mailed in a neighboring State, went through without delay to Mr. S. H. Smith, superintendent of the Marion Light & Heating Company. Figs. 5, 6 and 7 give an idea of the appearance of some of Marion's business streets at night.

COURT HOUSE OUTLINED.

The most novel sight for the visitor is the outlining of the county court house in the middle of the public square upon which most of the business houses face. It is certainly a novel sight to see a public building like a court house outlined, but it is a great advertisement for Marion, and the merchants appreciated this when they subscribed the money to install the wiring, which was done at a cost of 75 cents per lamp, the number of lamps being 750. In working up this scheme, Mr. E. T. Hollingsworth, contract agent of the company, and other gentlemen on the staff, used a very attractive method of showing how the court house would look when outlined.

A large photograph of the court house was obtained, of sufficiently dark finish to give it the appearance of a night setting. Tiny holes were punched in this photograph in the points where it was proposed to put lamps. The photograph was then mounted on the front of a box containing lamps, so that the light shone through these holes, thus giving almost exactly the effect which would be produced by the actual outlining at night.

FIG. 5.—A MARION STREET AT NIGHT.

The scheme, although simple, works out beautifully, and doubtless had much to do with the putting through of this plan.

NON-PEAK LIGHTING.

The sign and outline lighting, which is seen in such profusion, is also taken on a kind of non-peak contract. This is taken on a flat rate of $1 per 2-cp lamp per year (about 5.7 cents per kw-hour), renewals being paid for by the consumer. The company turns on and off these lamps, and they burn from 6 to 11 p. m. in winter and from dusk to 11 p. m. in the summer. These are on a separate sign circuit which is run around the square and

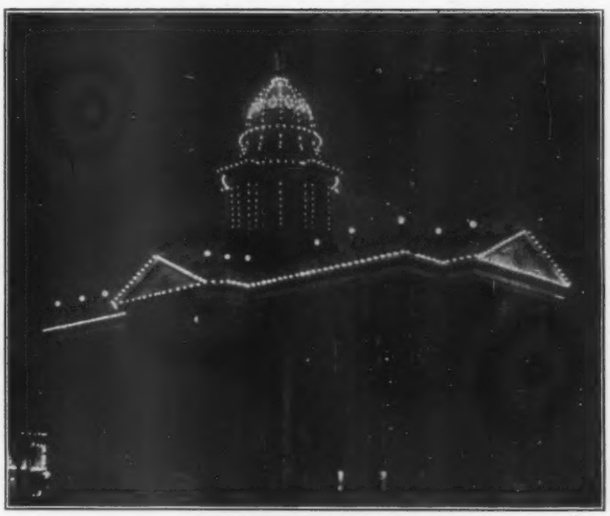


FIG. 6.—OUTLINE LIGHTING OF COURT HOUSE.

tapped from the regular secondary lighting network at two points. This business differs from the flat-rate sign and outline lighting which has been worked up by other central-station companies in two important respects. It is turned on at 6 p. m. in the winter instead of dusk, and it is on a separate sign and outline circuit, so as to be turned on all at once instead of having a patrolman turn on each customer's lamps separately. The separate sign and outline circuit is a necessary accompaniment of the non-peak feature of these contracts. If signs are

turned on about dusk, the consumer is not particular as to 10 minutes more or less at the time of turning on. When, however, they are turned on at 6 p. m., the hour when the greatest number of people are on the streets going home, in winter, it is highly important that all these signs be switched on exactly on the minute, as a few minutes' delay would cause serious protest by the merchant. Although non-peak power contracts require the consumers to shut down their motors until 6:05 p. m., the signs go on at 6 p. m. The sign lighting thus really overlaps the interior store lighting peak more than the power business, but the five minutes after 6 p. m. are to the merchant, who is trying to attract attention on the streets, the most valuable part of the day. Sign and outline lighting is billed to consumers as "Electric advertising."

ARCHES.

As seen from the night picture (Fig. 6) one of the characteristics of Marion's down-town streets is the electrically-lighted arches. Each arch is paid for by the four nearest merchants. The company erects these arches under a two years' contract for $15 per month rental, which includes current for lighting,

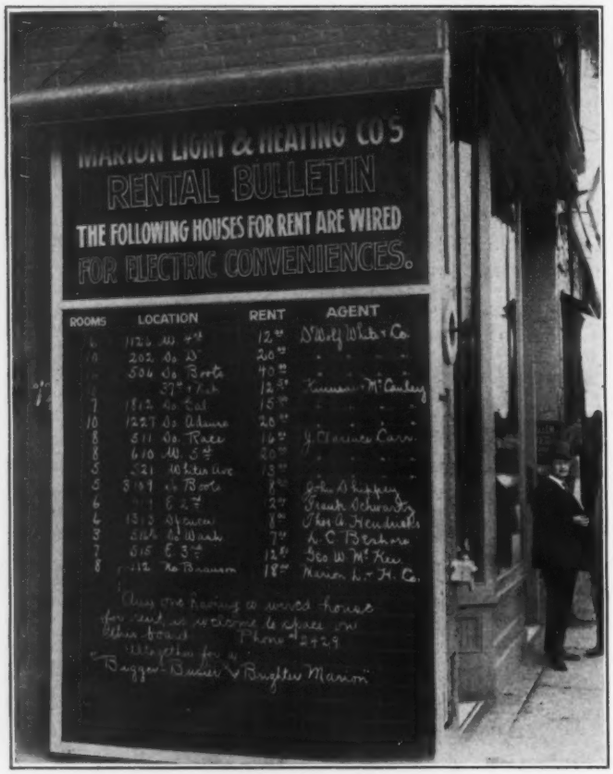


FIG. 7.—FREE BULLETIN BOARD FOR HOUSES TO RENT.

but not lamp renewals. The arches cost about $100, and are made of iron pipe. The span wire between buildings helps support the arch in the center, and it is also guyed lengthwise of the street. Each arch contains 60 lamps of 4 cp, the lamps being of different colors. There are 10 such arches. These arches, like the sign and outline lighting, are turned on from 6 to 11 p. m. in winter and from dusk to 11 p. m. in summer.

The company's regular lighting rate is 10 cents per kw-hour for amounts less than 50 kw-hours. Over 50 kw-hours and less than 100 it is 9 cents per kw-hour, and so on by steps up to 800 kw-hours, above which the rate is 8 cents. The company also has a flat lighting rate for stores at 60 cents per month per 50-watt Gem lamp for stores closing at 11 p. m. No free lamp renewals are furnished.

The company is recognized as one of the most public-spirited concerns in Marion. The talking electric sign in front of its office is used most of the time in boosting for others rather than advertising the company's product. Recently the company gave its services to aid Marion in securing a political convention by offering to light the town specially for that occasion.

The company has printed and keeps in stock a sign for hanging in vacated houses which are wired for electric service. This sign reads: "THIS HOUSE IS WIRED FOR ELECTRIC CONVENIENCES. Call us and our man will call and arrange with you for electricity. Marion Light & Heating Company." The word "electric conveniences" has been adopted very wisely as covering the case more completely than could any other one word in conveying its meaning to the general public, the word "service" being too technical.

Another good advertising scheme is that of an electrically-lighted bulletin board for vacant houses wired for electrical conveniences. This bulletin board (seen in Fig. 8) is placed on one side of the company's office building. Anyone having a wired house for rent is welcome to space on this board. It will be noted that a number of the houses advertised are small, which is an encouraging sign that electricity is getting into the smaller class of dwellings. An advertisement is kept in the interurban cars advertising "Cheap electric power for factories" at Marion.

The increase in gross earnings for 1907 was 31 per cent, the increase in net earnings being 37.9 per cent. The company's gross earnings per capita of population in 1907 were $6.46. The gross earnings per rated kilowatt of station capacity were $80.75. This is figuring on the rated and not on the permissible overload capacity of the station. The investment per rated kilowatt of station capacity is $375. Under ordinary conditions of central-station operation such gross earnings with such investment would not be sufficient for profitable operation and a proper allowance for depreciation. In the case of the Marion company, however, the operating expenses are considerably lower in proportion to the gross receipts than is common among central-station companies because of the high load factor which this company, by its peculiar business policy, has been able to maintain. The company has about 2200 consumers, of which 1800 are residence consumers and 100 power consumers. About 800 electric flatirons are in use.

The Marion Light & Heating Company is one of the companies controlled by the American Gas & Electric Company, of Philadelphia. The superintendent at Marion is Mr. S. H. Smith.

New Business Methods at Scranton, Pa.

Electrically, Scranton, Pa., has had quite a transformation during the past year or since the American Gas & Electric Company has taken over the management and operation of the various companies. During the past year the company has installed additional machinery having an aggregate rating of 5000 kw to take care of new business. Scranton, being in the heart of the anthracite coal region, it is a rather difficult matter to install motors in the face of very cheap coal. However, the general manager, Mr. Tidd, and the head of the new-business department, Mr. Campbell, despite heavy odds have made material progress, even going so far as to install electric motors at the very mouths of three coal mines in three coal breakers. Moreover, the prospects are bright for several more breaker installations of larger size.

The new-business department of the Scranton Electric Company consists of a new-business manager, a sign expert, two power experts and eight representatives. The representatives have separate districts of the city in which they act as managers. They are directly responsible to the new-business manager for conditions of lighting and service in their various districts. The representatives handle not only interior, but exterior and decorative lighting in all its forms and look after motor business as well. The representative takes care of the general interest of the company, solicits new business, attends to complaints, makes friends for the company and familiarizes himself with general business conditions. He plans illuminating installations, advises as to types of lamps and reflectors, acts as go-between for the consumer and the company, and in general maintains the best feelings between all parties concerned.

The representatives report flaws in the service, poor light and deficient service, in this way directly connecting the consumers with the distribution and operating departments. Each representative also acts as a salesman of appliances, placing and demonstrating irons, percolators, etc., and a representative is placed in charge of the salesrooms until 10 o'clock each night.

Every morning at 8 o'clock there is a meeting of the new-business department at which the representatives give their reports of the previous day's work. Suggestions are given and plans are mapped out for the coming day's campaign at these meetings. In the meeting room there is a blackboard upon which is put the name of each representative with the daily and weekly revenue secured by each in the way of connected business. Stenographic notes are taken of what is reported or suggested and kept in the form of minutes of the new-business department. During the past year the new-business department has increased the company's net revenue from decorative lighting alone over $40,000 from over 360 contracts for sign, outline and window lighting.

In handling the decorative lighting, the company works on a flat-rate basis, charging so much per annum for each 4-cp equivalent installed. The lamp circuits are switched on at dusk by the company and are extinguished at midnight; thus each sign, outline and window lamp is burned on an average of 2190 hours yearly. In this campaign much credit is due the company's sign expert. The representatives work with the sign expert to create a demand for a sign in the mind of the customer. Sketches of signs are submitted and the one chosen is then built and sold direct to the customer by some sign company having no connection whatever with the electric-light company. The sign is also hung by the customer or builder, the electric-light company simply furnishing the lamp renewals and the energy. The reason for this arrangement is that the company feels that when a man pays for something, he appreciates it far more than if it were given to him, and when the sign is the property of a merchant whose store front it adorns, he is more apt to care for it than he otherwise would. The company's idea is to strive in all cases for individuality in the design of signs, and uses ideas suggested by the merchants, by the sign expert and the representative.

The same system of work applies to outline lighting. The outline circuits are installed by the customer, the electric-light company being responsible for its service wires and lamp renewals alone. The lighting of show windows is made a specialty by the company, whose principle has been to use without fear or favor lamps and reflectors which distribute the light best. Usually this has been done with the aid of trough or hood reflectors placed at the upper front and sides of the windows, the reflectors being so inclined as to throw light over the greatest possible area. Windows have opaque borders painted across their tops so as to hide the light source and give the effect of brilliance without the annoying glare of the incandescent lamp.

The Scranton Electric Company's two power experts are men who understand every form of steam, gas and electric drive. These men gather data from the various plants as to running costs, general operating expenses, deteriorations, etc., and then install electric drive. They are equipped so as to be able to handle an installation from a static machine in a doctor's office to motors in a coal breaker, having some hundreds of horsepower demand. The motors are installed at the expense of the consumer, the service connections only being made by the company, which assumes no responsibility other than maintaining its lines. In the past 12 months contracts have been secured and services connected for 2000 hp.

The advertising is in charge of the new-business manager. The company carries its advertisements in all daily and weekly papers, using a 10-in. space as a rule. This form of publicity has been found to be very profitable in bringing electricity before the public shorn of its technicalities. The various papers have given the company many editorial and news items and have commented favorably on the company's distribution of fans, pencils, post cards, buttons, etc., bearing the company's motto, "Watch Scranton Grow."

The Tungsten Lamp.

AT a recent meeting of the contract and inspection department of the New York Edison Company, Mr. E. F. Tweedy presented a paper dealing in an interesting manner with the tungsten lamp, both technically and with relation to the business questions which its introduction is bringing forward.

After an account of the raw material, the several processes of filament manufacture are sketched. In the paste process, originally developed by Auer in the manufacture of the osmium lamp, fine tungsten is mixed with a suitable binder and the resulting paste is squirted through diamond dies under great pressure. The resulting filament is then heated in an atmosphere of steam and hydrogen to remove the carbon in the binding material, which leaves a filament of almost pure tungsten.

In the process developed by Drs. Just and Hanneman, which is followed in the manufacture of the Just lamp, a large number of which are now in use in this country, a fine filament of carbon is heated in the presence of tungsten, which is deposited in the form of a shell upon this carbon core. By the application of heat the tungsten and carbon are made to unite chemically to form tungsten carbide, which is then reduced and the carbon removed by a method similar to that employed in the process first described. It is extremely difficult to completely remove the carbon by this process without the formation of tungsten oxide, the existence of which is decidedly detrimental to the usefulness of the lamp.

In the Kuzel process, which was invented by Dr. Kuzel, an arc is formed between tungsten electrodes under water, or possibly some other liquid, and a so-called colloidal solution is formed which is then brought to the proper consistency and squirted through dies. The principal advantage of this method over the two preceding ones is the absence of any organic matter, which, when present, is completely removed with considerable difficulty, and if allowed to remain tends to destroy the usefulness of the filament.

A new method to be employed in the manufacture of tungsten filaments has just been patented in England by the British Thomson-Houston Company and has apparently been developed by the General Electric Company in this country. By this method it would appear that tungsten can be made sufficiently ductile to be drawn into a wire, which has been impossible heretofore, and the accomplishment of which should prove to be a decided step in advance. The method, as briefly described, consists in reducing an oxide of tungsten and mixing the powder thus obtained with an amalgam of cadmium and mercury. The plastic mass which results is pressed through a die in the usual manner and the cadmium and mercury are then driven off by heat. The resulting filament possesses the usual brittleness, but, after being heated to a moderate temperature, it becomes pliable and may be readily bent into any desired form. It is stated that it is possible to draw tungsten wire from rods of the metal, prepared as above, simply by maintaining the metal and the dies at the proper temperature.

The average life of the multiple tungsten lamp can probably be taken at 1000 hours, although the manufacturers do not guarantee an average life in excess of 800 hours. The series tungsten, which is now being adopted extensively for street lighting, is showing a life somewhat in excess of the multiple 120-volt lamp, and a life of about 1500 hours may be reasonably expected in this class of service. The degree to which candle-power is maintained throughout life is remarkable in the tungsten lamp, and is especially noteworthy when comparing this lamp with the carbon- or graphitized-filament lamp. In the carbon lamp the falling off in candle-power is comparatively rapid, and, after burning 400 or 500 hours, the initial candle-power has generally been reduced by about 20 per cent. With the tungsten lamp the decline in candle-power from its initial value is of small amount, probably never exceeding 15 per cent after 1000 hours of burning and often being in the neighborhood of 5 or 6 per cent. While the watts per candle increase rapidly in the carbon lamp as the hours of burning increase, the effi-

ciency of the tungsten lamp remains more nearly constant throughout its life. These facts should be borne in mind, therefore, when comparing the two types of lamp on the basis of cp-hour costs.

The two points chiefly raised against the tungsten lamp at the present time are its fragility and its high cost. That there is room for improvement in both these respects, no one will deny; that such improvement is almost sure to come seems equally certain. The present fragility of the lamp should not be of serious consequence to the user, provided reasonable care is employed in its handling. The manufacturers have largely overcome the difficulties first encountered in the matter of shipment, and the breakage has now been reduced to less than 1½ per cent, as compared to something over ½ of 1 per cent for carbon lamps.

The manufacturers advise the users of tungsten lamps to turn on the current when cleaning the lamp or shade, as the filament becomes plastic when hot and is much less subject to breakage. The desirability of controlling tungsten lamps by either a pendant or a wall switch might be mentioned. Where the lamp is turned on at the socket, the possibility of breakage is considerably increased.

The quality possessed by the tungsten filament, in common with filaments made from other metals, of welding after being broken, is of considerable value. The author recently observed this phenomenon in the case of a 100-watt lamp, which welded, upon being handled, after having burned 650 hours. It then burned for an additional 70 hours before final disruption. Another lamp of the same size has been welded three times and has now burned 150 hours since the last weld.

The question of burning this type of lamp in other than pendant position is often raised. The manufacturers advised strongly against doing this when the lamp was first placed upon the market, and some manufacturers still state that the best results will be secured if the lamp is used in a vertical pendant position.

On the other hand, several manufacturers are now claiming that their lamps may be burned in any position. Recent experiments seem to show that little trouble will result from burning these lamps, particularly the 40- or 60-watt sizes, in other than a pendant position, provided the angle with the vertical does not exceed approximately 45 deg.

In considering the commercial effect of the introduction of the tungsten lamp, the present, together with the possible users of electric light, are divided into three classes according to their probable relations to this new illuminant. The first class consists of existing customers who are now using electric light at what might be termed the "point of saturation" based on the present standard of illumination, thereby reducing their watt capacity and consequently decreasing the revenue of the central station.

To illustrate this a concrete example of this class was cited. The United Cigar Stores Company has consistently recognized the advertising value of brilliantly lighted stores. To carry out this idea effectively it has been a large consumer of electricity, its total outlay for electric lighting on Manhattan Island alone during the year 1907 being about $80,000. By means of the tungsten lamp they now expect to reduce this expense by nearly one-half, without sacrificing in the slightest degree the present high standard of illumination.

The second class is likewise composed of present customers, but in their case the illumination is below the "point of saturation" above referred to, for the present standard of illumination. This class has limited its quantity of illumination, the reason for this being largely one of dollars and cents. The question now arises as to whether this class will utilize the tungsten lamp for the purpose of securing the same illumination for less money, or to secure a greater amount of illumination for the same money. The latter alternative seems more probable, but central stations cannot wait passively for such a result.

It is time for active work among such a class of customers, in order to point out to them the advantages which they will derive from a greater amount of illumination, now that a cheaper source of light is at hand. Unless this is done, central-station income from this class will probably be diminished, at least temporarily. It is very probable that multiple lamps of small candle-power will soon be upon the market; in fact, a 110-volt tungsten lamp of 20 cp, consuming 25 watts, was exhibited at the recent Chicago convention, and appeared to be a complete success. A lamp of this and smaller size will find an extensive field in the lighting of the home. In using this lamp for domestic lighting, however, considerable care must be used in the manner in which it is installed. The carbon lamp with clear glass bulb and without a diffusing shade is frequently placed directly in the line of vision. With the tungsten lamp, the intrinsic brilliancy of which is over twice that of the carbon lamp, the practice above described must be discontinued, or else the money saved in light bills will soon reach the pocket of the oculist.

The tungsten lamp must be installed well above the line of vision or else be so shaded that its intrinsic brilliancy will be largely reduced, and this fact should be thoroughly impressed upon all customers who are about to install this lamp. It is evident that such a course is desirable from the central-station standpoint. By installing tungsten lamps in the manner described, the lessened efficiency of the installation, aside from the lamps, will offset in some measure the high efficiency of the light sources themselves.

The third class consists of those who are at the present time employing some means for securing illumination other than by electricity in the interest of economy solely. It is from this class that the lost revenue from classes one and two must be regained, and there is every reason to believe that not only will any possible loss be thus recovered, but that the electric-lighting industry will experience a tremendous growth as a result of its being able to secure a class of customers which has heretofore been unobtainable.

In order to secure those possible customers described under class three above, the New York company has decided upon a campaign directed, at the start, against the gas arc. A proposition will be made to the users of this type of illuminant whereby the company will arrange for the wiring and for the installing of a tungsten fixture to replace the gas lamp. The customer will be allowed to select his own fixture from a number of designs covering a considerable range in price, and the installation will be made under the customer's direction. The total cost of the wiring, the fixtures and the tungsten lamps will be assumed by the company, but this amount will be repaid by the customer, without interest, in 12 consecutive monthly payments, which will be added to the monthly bills for current. After the final payment has been made, the entire equipment excepting the lamps, which are to be returned at the end of their life, will become the property of the customer. If the customer should vacate the premises before the last installment is paid, or if the contract should be terminated before the final payment, it is understood that the installation may be transferred to the successor under a similar arrangement, to continue until all payments have been made. If such a transfer should be impossible, the original customer must pay the full amount necessary for a complete liquidation.

A few figures comparing the cost of operation of a gas arc to that of a tungsten fixture, giving approximately equal illumination, may be of interest. The majority of gas arcs, particularly those installed in small stores, are in service on a rental basis. The Municipal Lighting Company has a large number of arcs so installed. Their charges are 70 cents a month for a four-mantle lamp and $1 a month for the one having six mantles. These prices include maintenance, and adding the cost of the gas consumed by the lamp, the total operating cost is secured. Some figures recently obtained under actual working conditions were as follows: Cost of gas consumed by a four-mantle lamp burning four hours a day (excluding Sundays) for one month was $1.62; adding to this the rental charge of 70 cents makes a total monthly cost of $2.32. For equal illumination, a tungsten fixture would be required having four 40-watt or possibly three 60-watt lamps. Assuming the latter combination, with a life of

1000 hours for the tungsten lamps and current at 10 cents per kw-hour, a total monthly cost of $2.35 would result. To this might be added an interest charge upon the cost of the equipment, which would reach its full value only at the end of the first year when all payments had been made and is really too insignificant to be included, as the total cost of the equipment, excluding lamps, will rarely exceed $15. Compare the above figures and then take into consideration the many advantages possessed by the tungsten lamp not shared by the gas arc, namely, the color of the light, which is nearly a pure white, as compared with the greenish-yellow color of the gas lamp; a comparative absence of heat, the presence of which makes the gas arc decidedly objectionable during the greater part of the year; and, lastly, consider the fact that the atmosphere is not vitiated.

It is stated that a four-mantle gas arc consumes as much oxygen as a dozen people, and the truth of this statement is evident to one who has entered a certain class of small store on a winter's day. Even if the cost of a given amount of illumination is slightly greater with the tungsten lamp than with the gas arc—which is probably true in the case of certain inverted mantle arcs—the advantages enumerated above should outweigh any such slight difference in cost.

In closing, the use of the tungsten lamp for show-window lighting was touched upon. The conditions upon which satisfactory window lighting depends are, as a rule, simple and easy to secure, but are generally overlooked by the average shopkeeper, whose sole desire, apparently, is to project as much light as possible directly into the eyes of the passerby. The results of this are usually disastrous so far as the accomplishment of displaying goods is concerned. The fundamental requirements for effective window lighting are: (1) That the sources of light be concealed from the eyes of the passerby, or, if this is impracticable, that they be surrounded by diffusing globes or shades so that their intrinsic brilliancy will be largely reduced. (2) That a sufficient quantity of light be thrown upon the goods to be displayed so that the portion of this light which is reflected to the eyes of the observer will produce the desired effect, namely, a vivid visual perception of the goods which are on display.

There are a number of reflectors for window lighting now on the market and they are for the most part constructed on principles that will produce the result above stated. Tungsten lamps, vertically pendant near the window ceiling and equipped with concentrating reflectors, afford an efficient and extremely satisfactory method of lighting windows, particularly where the window has considerable height.

An example of window lighting along the lines above mentioned and employing the tungsten lamp is soon to be shown at the second district office of the New York Edison Company on Forty-second Street. The ceiling of each window has been studded with 28 100-watt tungsten lamps, each lamp being equipped with a concentrating reflector recently developed by the Holophane Company, which will produce a downward candlepower with the lamp mentioned of 650. The total downward light in each window will, therefore, be the equivalent of approximately 18,000 candles, which will produce an illumination at the bottom of the window of perhaps 60 foot-candles. When it is realized that 10 foot-candles is generally considered the maximum illumination ever required, even in rooms where drafting or etching is done, the above figures are significant. This will in all probability be the most brilliantly lighted window in existence.

While the average customer would probably not care to go to the extreme in window lighting above described, the advertising value of such a display would in many instances warrant the investment and operating costs of such an installation, particularly when compared with the cost of newspaper and some other forms of advertising. The company has set an example and is showing its confidence in its own "goods." The time is now ripe to advocate more and properly applied light in show windows, for a lamp is now available which makes this possible without increasing the cost to the consumer.

The Introduction of High-Efficiency Lamps in Boston.

Considerable progress has been made during the past few months in the introduction of high-efficiency lamps on the circuits of the Edison Electric Illuminating Company, of Boston. About 2000 tungsten lamps of the 100-watt size have been put out by the company thus far. This size of lamp was advertised and discussed by the company about the middle of last December, but as the lamps did not begin to arrive until February, it was not possible to do much active promotion until that time. The tantalum lamps thus far put out by the company total from 5000 to 10,000. Many thousands of the Gem lamps have been put out in the Boston territory. The company does not supply flaming-arc lamps, but there are now probably from 50 to 100 of these on its circuits, the lamps being supplied by the customer and also trimmed by him.

In any case where an ordinary lamp is supplied free, there is an excess charge of 5 cents for a 50-watt 20-cp Gem lamp; the 40-watt 20-cp tantalum and the 50-watt 25-cp tantalum are supplied at an excess charge of 30 cents; the 40-watt 32-cp tungsten, the 60-watt 48-cp tungsten and the 100-watt 80-cp tungsten are supplied at an excess charge of $1.10 each. The 100-, 125- and 250-watt Gem lamps are now supplied free by the company, the old carbon-lamp sizes above 50 watts, 16 cp, having been discontinued entirely. In all cases where the company renews an ordinary lamp free, taking back the old burned-out lamp, one of the new lamps is exchanged for the old one plus the excess charge. At one time there was an excess charge of $30 per month per pair for flaming arcs, but this has practically been discontinued. The 40- and 60-watt tungsten have just begun to arrive in Boston, so that these have as yet not been put out in any number.

From the company's experience so far it appears that the new lamps are effective in securing new customers. Mr. R. S. Hale, general agent, states that, roughly speaking, one-third of the new 100-watt tungsten lamps installed has meant new customers displacing 90-cent gas, while two-thirds installed for present customers temporarily decreased the income. Approximately one gas-arc is being replaced by 1½ tungstens of the 100-watt size. A few cases have occurred where the gas-arc is replaced by a tungsten of 100 watts, saving the customer about one-third of his former bill, but it is not considered quite as good lighting by the company when this is done. The point is that a very much better illumination is given by the tungsten lamp on the basis of 1½ tungstens of 100 watts replacing each gas-arc with about the same running cost. The breakage of the tungsten lamps, on account of the more fragile filament, is naturally much more than in the case of carbon-filament lamps. So far, the total loss on this account due to breakage in shipment from the factory to the Edison Company, in delivery from the company's stock to the customer's socket, and in early burn-out, say, within 50 hours' service, is running somewhere between 5 and 10 per cent.

In regard to residence service, a few customers are using tantalum lamps, but the percentage is very small, as the customers have to pay any excess charge for lamps. At the present moment the company is making a considerable effort to introduce the new lamp in order to replace gas, but there is no special effort being made to replace the company's own carbon lamps except in the cases of dissatisfied customers.

A new street-lighting schedule of rates has been drawn up by the company with the idea of meeting the new conditions imposed by the use of more efficient lamps. Electricity for street-lighting use will be sold under the new schedule as follows to municipalities:

Description of lamp.	Fixed costs per lamp per year.	Running costs per lamp per hour.
40-cp incandescent lamp	$10.80	0.25 ct.
60-cp " "	12.00	0.3 "
80-cp multiple lamp	14.40	0.4 "
425-watt alternating arc lamp	36.00	1.5 "
500-watt direct-current arc lamp	42.00	1.75 "

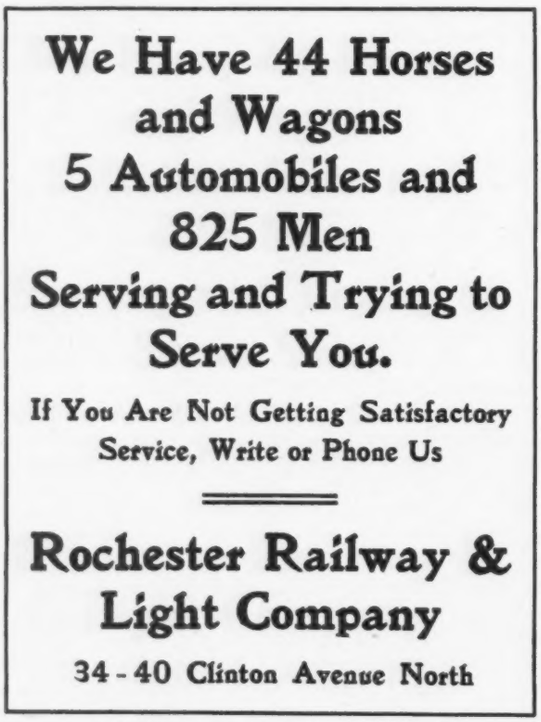
A first deduction allows a rate of 1 cent per hour per incandescent lamp and 3 cents per hour per arc lamp for all outages,

with suitable notice in writing. When agreements are made for periods longer than one year, 1 per cent discount is allowed by the company for each year up to 10. Monthly payments are required on the regular pay day of the municipality, and the company is not responsible for failure to supply current if such failure is without wilful neglect on its part. The company, under the terms in force, is not required to extend its lines unless the probable income appears sufficient to warrant the investment. Changes in the location of lamps can be made only at the company's option or at the expense of the municipality. Lamps are not allowed to be discontinued except when streets are discontinued, except that the company allows a reasonable number of lamps to be discontinued for reasonable cause, in which case a charge is made the same as for a change in location of all new lamps installed to the extent of the number discontinued, provided the number of lamps discontinued does not exceed 5 per cent of the total number installed up to that time. The schedule formerly in effect gave approximately the same price for 25-cp carbon-filament lamps that is now offered for 40-cp tungsten lamps. When the Gem lamp came out, the company gave 32 cp with it for the same charge formerly asked for the 25-cp lamp. The new tungsten lamps are going in very rapidly, and in a short time all the towns on the Edison system that formerly had 25-cp carbon lamps will be supplied with 40-cp tungsten lamps at a slightly less rate than the old price for 25 cp.

Effective Advertising.

The accompanying reproduction is a fac-simile of a newspaper advertisement of a class which is being used by the Rochester (N. Y.) Railway & Light Company. We are informed that, aside from holding and securing the good will of present customers, advertising of this kind has been found a profitable aid in securing new business.

When properly presented, as in the present case, such messages to the public can scarcely fail to be effective, as they


We Have 44 Horses and Wagons 5 Automobiles and 825 Men Serving and Trying to Serve You.
If You Are Not Getting Satisfactory Service, Write or Phone Us
Rochester Railway & Light Company
34 - 40 Clinton Avenue North

ROCHESTER NEWSPAPER ADVERTISEMENT.

serve at once to show the resources for giving satisfactory service, and to instill the idea that the company desires the public to get the full advantage of these resources. In fact, the direct call to attention is always effective in advertising if it is respectful in tone and conveys a message worthy of attention. It is, however, probably the most difficult kind of advertising to write, not only on account of these qualifications but also because, for best results, the matter should be condensed to few words.

The pitfall to many who attempt this class of writing lies in the use of slang or "red light" methods. "Don't be a chump" or a leering figure beckoning out of a column to the reader, may seem smart methods of attracting attention, and perhaps they serve their purpose with a certain class, as indeed even downright disreputable "catch" methods would similarly serve with a yet smaller class. But it always pays best to treat the public as if every member typified its best qualities, and to remember that even its roughest specimen is not callous to dignified call on his attention. However commonplace an advertising writer may consider the public he addresses, he should know that individually each member who can add to the business of a central station is a man of consequence in his home, or in his office or workshop; and putting the case on the commonest plane, he expects deference to be paid at least to his purchasing capacity, and is apt to resent the slangy or familiar type of appeal—particularly if read in his home or office—as he would the call of a solicitor offensive in his manners. During the past year or more the tone of central-station newspaper advertising has notably improved, and the above remarks have much less application now than they would in the earlier period of central-station awakening to the benefit of good advertising as part of "new business" campaigns.

Relations of the Central Station with the Public.

In a paper read by Mr. Walter Neumiller at a recent meeting of the staff of the contract and inspection department of the New York Edison Company, the importance of maintaining good relations with the consumer was discussed in detail.

There are four ways in which a company comes in contact with the public: by personal calls through its representatives, by calls at the company's offices, by means of the telephone and the mail. Each of these can be made effective means of courting the good will of the public.

The outside representatives of a company should fully realize the responsibility which rests upon them so far as the shaping of the public's opinion of the company is concerned. Ordinarily a representative will make about 30 calls a day. A company, therefore, with but 25 representatives reaches during the year more than 250,000 people. The opportunity here presented can hardly be overestimated. Polite address, a readiness to impart information relating to any department of the company's service, making a customer feel that it is the desire of the company to treat everyone with courtesy and fairness—all these things are bound to result in a more favorable attitude toward the company.

Even a greater opportunity to gain the good will of the public is possible by courteous treatment of office visitors. The establishing of conveniently located district offices where any business pertaining to the company's service may be transacted; clean and comfortable offices, where the public is politely received and its wants attended to promptly and intelligently; show rooms where, though the company itself does not deal in the apparatus shown, the latest appliances are on exhibition and impartial information given concerning them—all these things are bound to impress the public with the fact that the company is desirous of serving the community, to the best of its ability. Here is where the seemingly insignificant member of the organization—the office boy—plays an important part. He is the first person with whom the visitor comes in contact, and is the index (as he has so often been called) to the company's organization. He can, in the few moments during which the customer makes known his wants, by his polite and ready-to-serve manner, reflect the company's attitude and shape the first impression which usually is the one lasting longest.

The third channel through which the company comes in contact with the public, the telephone, can be made a very effective means of creating a favorable impression. There is nothing

more pleasing to a customer calling up a company than a courteous and intelligent response to his inquiries. Upon the other hand, what can be more aggravating than a disinterested or impolite answer, especially when the customer has a grievance—real or imaginary—which he desires to communicate? One of the newer department stores in the city makes it a practice in filling telephone orders to call up the customer shortly after the goods are delivered to ascertain if the selection has been properly made and the merchandise satisfactory. Such attention as this is bound to result in increased patronage. While public-utility companies do not sell over the telephone, similar attention can be shown, however. In the case of inquiries, for instance, instead of keeping a customer waiting while the information is being obtained, his number can be taken, and the information imparted later. Other opportunities will suggest themselves.

Lastly, the correspondence can be made a fruitful means in the cultivation of the public's good will. All mail inquiries, and especially complaints, whether well founded or not, should be answered on the day on which they are received, or if it is necessary to make a lengthy investigation, they should at least be acknowledged until a full reply can be sent. It should be remembered also that it is as simple to make a letter polite as it is to make it otherwise; a little attention on this point is well worth while.

The question of correspondence suggests a frequent cause of annoyance which seems worth mentioning. It is the incorrect spelling of a man's name or the use of the wrong initials. Most people are sensitive on this point, and with a little care irritation resulting from this cause can be entirely eliminated. Perhaps the best and most fruitful opportunity for making a favorable impression upon an individual customer's mind is when he makes a complaint. As Mr. Arthur Williams said at the recent convention in Chicago: "We should look on a complaint as an opportunity to get better acquainted with the customer, and to get him better acquainted with our work and ideals."

Central-Station Progress at Mt. Carroll, Ill.

The Mt. Carroll Electric Light Company, Mt. Carroll, Ill., of which Mr. A. M. Webb is president, has built up a profitable business in the past three years since Mr. Webb took hold of the property. It is now successfully competing with gas and gasoline by the use of tungsten lamps. In fact, it cannot get these lamps fast enough to fill its orders. An interesting development soon to take place will be the starting of a day circuit to operate on Tuesday mornings only. This will be the forerunner of a regular all-day circuit for motors; the Tuesday morning idea being, of course, to accommodate flat-iron users.

LETTER TO THE EDITORS.

German Central-Station Police Regulations.

To the Editors of Electrical World:

SIRS:—In the issue of June 6 comment is made on the proposed German police regulations, which appears to involve a misunderstanding of the nature of these regulations. First of all, the word "police" has been misunderstood. The body which originated the regulations is the "Royal Police Prasidium," whose president is a lawyer with considerable experience in government administration. The Royal Police Prasidium comprises some 12 departments; one of these is the executive police department, and others are the sanitary department, department of building inspection, fire department, department of combustibles, etc. The department of building inspection has on its staff representatives of all branches of engineering science, all graduates from technical courses. Even the lieutenants, captains, etc., must have, according to the latest regulations, a complete technical education, except those in the executive departments. None of the members in charge of inspection wear uniform; they are "plain clothes men" as here—even without the customary badge or official suspender buckles. If in some cases a lieutenant of the executive department accompanies the commission, it is only in order to dispel any doubt as to whether the owner has to admit the commission to his premises or not.

As to the voluminousness of the regulations, this is not as great as would appear at first glance. As you state correctly, the regulations complete comprises the regulations of the German Electrotechnical Association, and the ordinances relating to central stations and to factories of certain kinds. The voluminous appendix is an interpretation of the regulations, and written more for the lawyer and judge than for the station manager; its purpose is to close all back doors of the law so tightly and firmly that no one can avoid observing the regulations without conflicting with the law.

The opinion expressed that the station manager is relieved of responsibility if official approval has been given does not cover the facts. On the contrary, if anything happens in a central station it is through neglect of the regulations and thus in violation of the law, for which the delinquent is subject to a fine; the result is greater care on the part of the station manager and his force.

NEW YORK. ARTHUR SACHSSE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Standardization Rules in United States and Germany.—G. STERN.—A comparison of the standardization rules of the American Institute of Electrical Engineers and of the German Association of Electrical Engineers, for electric machines, transformers, etc. The comparison shows that there are great differences concerning certain rules which, however, are not so much regulations as recommendations (as to overload of machines and transformers, standardization of voltages, frequencies, etc.). In the really obligatory rules (as to increase of temperature, measurements of efficiency, insulation tests, etc.) differences exist, but they are not of an important nature, so that they can be overcome. The author thinks that the standardization rules of both countries can be improved by mutual discussions.—*Elek. Zeit,* June 4.

Leakage Flux in Transformers and Commutator Motors.—W. ROGOWSKI AND K. SIMONS.—The authors develop a new mathematical theory which differs in various respects from former theories, for the stray fluxes in alternating-current transformers and commutator motors. The special feature of their theory is that they start from the conception of the coefficients of self-induction and mutual induction. They describe two new methods for measuring the primary and secondary leakage reactance voltages separately. These are based on the law that only the stray fluxes are present when the primary and secondary ampere turns are equal, and the phase difference of the currents is 180 deg.—*Elek. Zeit.,* May 28 and June 4.

Hysteresis Loss in Induction Motors.—H. ZIPP.—An article illustrated by diagrams, in which the author shows by a simple graphical method why the hysteresis loss suddenly decreases by an appreciable amount when the speed rises from a value below synchronism to a value above synchronism. The principles of the so-called hysteresis motor are also discussed.—*Elek. u. Masch.* (Vienna), May 24.

Lamps and Lighting.

Two Hundred and Twenty-Volt Tungsten Lamp.—The company making the Just tungsten lamp has placed 220-volt, 50-cp

(hefner) lamps on the market. Twelve lamps of this type have been tested with direct current by the Reichsanstalt and 10 lamps of the same type with alternating current in the laboratory of the company. It is found that the high-voltage lamps are only slightly inferior to the low-voltage lamps with reference to specific power consumption, while they are just

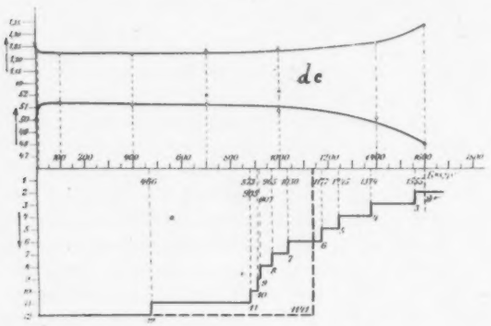


FIG. 1.—TUNGSTEN LAMP TESTS.

as good with respect to life and durability. The results of two sets of tests are given in Figs. 1 and 2, of which the first gives the direct current tests and the second the alternating-current tests. In both figures the highest curve represents the specific consumption in watts per hefner candle-power, the next lower current represents the variation of the light in hefner candle-power, while the lowest curve shows the life.

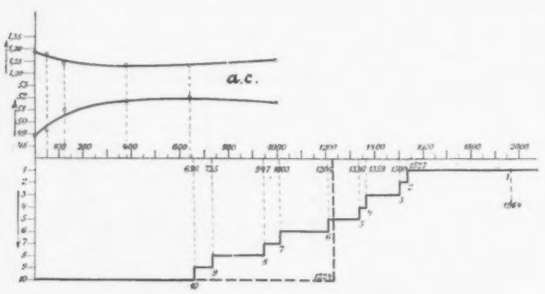


FIG. 2.—TUNGSTEN LAMP TESTS.

The abscissas are hours. It will be seen that the direct current tests of the Reichsanstalt were extended to 1600 hours, two lamps being still good at the end of the test. The first lamp failed after 466 hours. The mean life in this case was 1411 hours, while the mean life in the alternating-current tests was 1224 hours.—*Elek. Zeit.*, June 4.

Tantalum Lamp.—F. W. Willcox.—Most of the tantalum lamps used in this country are of the 50-watt, 25-cp and of the 40-watt, 20-cp ratings. The lamp has been received best in central-station service where the central station does not supply free renewals of carbon lamps, as customers of such stations, accustomed to buying their lamps, will more readily purchase and try the tantalum. The average life on direct-current service runs well beyond the guaranteed figure of 800 hours, with many lamps lasting for 1200 hours and more. The life on alternating-current service is below that on the direct current. The alternating-current life varies with the frequency in about the following ratio:

Frequency.	Per cent of life with direct current.
25 cycles	58
37 cycles	46
60 cycles	31
133 cycles	7

A large part of tantalum-lamp installations has been made on isolated plants. Its most successful service has been given on such plants in relieving overloaded apparatus, and in giving additional illumination without any increase of generating equipment. The tantalum lamp is of particular value in train lighting service by reason of its high efficiency, and also because it is substantial enough to withstand the vibration and rough service. It can be supplied in 10-cp rating, for 30 and 60 volts. Some data are given on the use of tantalum lamps in various New York office buildings.—*Gen. Elec. Rev.*, June.

Transformers for Metallic-Filament Lamps.—An illustrated description of a new type of transformer made by an English company for reducing the voltage for metallic-filament lamps. The design is such that the voltage regulation is within 2 per cent and the power factor is given as 0.98 at half and 0.99 at three-quarter and full load. They are listed in ratings ranging from 300 to 1000 watts, both as plain transformers for secondary e.m.f's. of 100, 50 and 25 volts, and also as auto-transformers for half the primary voltage. The following particulars of a transformer for 450 watts, 200 to 25 volts, 50 cycles, gives a general idea of the weights, efficiencies, etc.: No-load loss, 9 watts; efficiency at from half to full load, from 96 to 98 per cent; overall dimensions, 10¼ in. by 9½ in. by 5½ in.; weight, 34 lb.—Lond. *Elec. Eng'ing*, May 21.

Metallic-Filament Lamps.—Several letters suggesting shorter names, namely, either "wire lamp" or "metal lamp." Since most of the new lamps have a specific output in the neighborhood of 1 cp per watt, one correspondent makes the suggestion to call them "candle-watt" lamps.—Lond. *Elec. Eng'ing*, May 21.

Generation, Transmission and Distribution.

Transmission Line.—A. Blondel.—The author applies his graphical and analytical method of treating alternating-current phenomena to the problem of the efficiency of energy transmission over a line. While in direct-current transmission the efficiency always increases with increasing voltage, this is not so with alternating current. In the latter case the charging current of the line increases with the voltage and this disadvantage gradually counterbalances the advantages of increasing voltage. For transmitting energy at a given rate over a given line there exists therefore a voltage at which the efficiency is a maximum. It is interesting to determine this e.m.f. in a given case in order not to use a higher value; in most cases in practice the most favorable voltage is too high to be obtained.—*La Lumière Elec.*, May 23.

Shop Tools.—L. R. Pomeroy.—An illustrated paper on the generator requirements of railroad shop tools. Generally speaking, for railroad repair shops, the generator rating equals approximately 15 kw per locomotive pit, or space in erecting shop occupied by one locomotive. This value comprehends requirements for tools, cranes, heating, blower and exhaust fans, that is, provides for all power required except for lighting. The tools alone require from 9 to 10 kw per pit; heating, blower and exhaust fans, 5 kw per pit, while 3 kw per pit will care for the ordinary shop and adjacent yard lighting. If power is required for lighting terminal yards, buildings, etc., in addition to shop requirements, an increase in generator rating must be made to cover such contingencies. Curves are given showing the motor requirements of lathes, drills, shapers, planers, etc., with numerical examples.—*Eng'ing News*, June 18.

Distortion of Shafts.—M. Kroll.—An illustrated description of a simple electrical method for determining the distortion of revolving shafts under torque.—*Elek. u. Masch.* (Vienna), May 24.

Traction.

Electric Traction on Swedish Railways.—An account of the report of Dahlander on the trials which have been made on two sections of Swedish railways (12 miles in length) with electric traction. The single-phase system with commutator motors was used exclusively since it was considered to be the one best adapted. The higher cost of the power plant and the higher cost and weight of the single-phase motors were found to be of less economical importance than the greater cost and greater complication of the line equipped with the three-phase system. DeLaval steam turbines were used as prime movers. Tirrill regulators being employed for regulating the voltage. Attention was chiefly paid to the construction of the line, various methods of suspending the trolley wire being employed. The voltage drop in the rails, even without copper joints, was

found comparatively low. A great portion of the current, however, goes through the earth, especially when the soil is moist. It is thought that rail joints, which are always employed with direct-current lines, may not be necessary with high-tension alternating curent. The trials were made with a 300-hp locomotive of the Westinghouse Company, a 300-hp locomotive of the Siemens-Schuckert Company, and a train of two 230-hp motor cars and two trailers of the Allgem. Elek. Ges. The commutators were found to behave in an excellent way and no trouble whatever was experienced. No reason was found to give preference to any of the different single-phase motors employed. The energy consumption on a 6-mile section was found to vary between 13.9 and 19.9 watt-hours per ton-kilometer for a round trip, the speeds varying between 31.4 and 48.2 kilometers per hour and the train weighing between 145 and 265 tons. The chief results are that it is thought safe to use a trolley e.m.f. of 15,000 volts and that while the most suitable frequency may be between 25 and 15, 25 will probably be the best frequency for Swedish conditions. The introduction of electric traction on the Swedish railways is to be carried out gradually.—*Elek. Zeit.*, June 4.

Single-Phase Railroad.—S. HERZOG.—An illustrated description of the single-phase railroad from Seebach to Wettingen in Switzerland, which has been in regular operation for several months. The trolley e.m.f. is 15,000 volts, the frequency 15. There are three locomotives; two have been built by the Oerlikon Company and the third by the Siemens-Schuckert Company. The equipment of the latter, which has four series motors, is described and illustrated. The construction of the trolley line is also described, together with the precautions which became necessary to prevent disturbances in the telephone lines parallel to the railroad. For the latter purpose it was necessary to rebuild the armatures of the motors in order to prevent higher harmonics of the e.m.f.—*Elek. Zeit.*, May 21 and 28.

New York Subway.—L. B. STILLWELL.—An article giving experimental data on the energy required to operate express and local trains in the New York Subway during rush hours and non-rush hours. The results are interesting, as they show the accuracy with which railway operation can be predetermined theoretically.—*Elec. Ry. Jour.*, June 6.

Youngstown.—C. W. RICKER.—An illustrated description of the Youngstown & Ohio River Railroad which when completed will have a length of 35 miles. The power house contains two 1000-kw turbo-generators, with space for another unit of 2000 kw.—*Elec. Ry. Jour.*, June 13.

Installations, Systems and Appliances.

Self-Synchronizing Rotary Converter.—An illustrated description of a 600-kw rotary converter installed in a substation in Glasgow in which use is made of a method of starting up from the alternating side, by which the machine is self-synchronizing when connected to the line. The machine converts from 25-cycle, three-phase, 6000-volt currents to direct current at from 470 to 600 volts, for lamp and motor supply. The machine is provided with an "amortisseur" damper specially designed to give a good starting torque. It is able to start and run up to synchronous speed with no more than one-fifth of the normal voltage on the slip-rings. Fig. 3 shows the connections of the controller in the "off" position, starting position and the running position. It will be seen that in the starting position only three phases at a reduced voltage are connected to the slip-rings. The machine starts up, excites itself and goes into synchronism. The controller is then thrown over to the running position, and if the polarity is reversed it can be rectified by momentarily obtaining shunt-field current from the station busbars. The commutator e.m.f. can be varied over a range from 470 to 600 volts by means of the field rheostat of the alternating-current booster, without affecting the power factor. The latter can be adjusted independently throughout the entire range of voltage by regulating the field resistance of the rotary. The booster consists of a small alternating-current generator, mounted between the slip-rings and the machine itself. No additional brush-gear or moving contacts are necessary, however, as the rotating armature of this generator is connected on one side to the slip-rings, and on the other side to the armature windings of the rotary. The field coils of the booster receive energy from the direct-current side of the rotary and may be arranged with series turns to compensate automatically for load variations, or it may give a regulation curve similar to that of the generators with which it has to

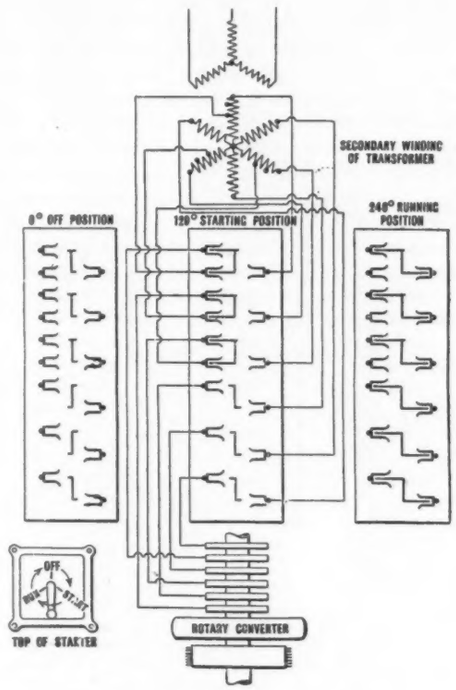


FIG. 3.—CONTROLLER CONNECTIONS.

run in parallel. The ability to vary the power factor and the commutator voltage independently is of great importance, as a leading current can be drawn from the line to compensate for lagging currents in other apparatus, or the power factor may be maintained at unity.—Lond. *Elec. Eng'ing*, June 4.

Balancers.—A. IMBERY.—The author discusses with the aid of diagrams the different uses and connections of load balancers. Steam-driven balancers are a very useful adjunct in central-station equipments, as they can be used to assist other generators on peak loads and thus save the necessity and expense of starting another generating set, doing the balancing and carrying peak loads at the same time. The use of motor-driven balancers is then discussed and the advantage of balancing the loads on very large networks with over-compound-wound balancers is pointed out. In all balancer switchboards the provision of no-voltage release attachments is very important.—Lond. *Elec. Rev.*, May 29.

Converter Substations.—J. E. WOODBRIDGE.—An article giving instructions to operators in railway converter substations, referring to the switching of high-tension circuits, the care of transformers, converters and commutators, the starting of converters and the power factor of railroad converters. The author gives a number of practical hints on the manipulation of the machinery in normal and emergency conditions.—*Elec. Ry. Jour.*, June 13.

Polyphase Connections.—H. W. BROWN.—To make connections to polyphase circuits, care must be taken to get the right combination of currents or e.m.fs. The author shows that it is easy by means of vector diagrams to select the right connections for some of the more common polyphase circuits.—*Elec. Jour.*, June.

Transformer Substations.—C. M. HACKETT.—An illustrated article giving some suggestions on the general construction and arrangement of small transformer substations.—*Gen. Elec. Rev.*, June.

Wires, Wiring and Conduits.

Voltage Chart.—R. W. Stovel and N. A. Carle.—An article giving a chart for the graphical determination of the voltage drop in direct-current feeders. The loss of voltage equals 10.7 × amperes × length of circuit in feet divided by the circular mils in the wire. The relations between any three varying factors can be shown graphically on a sheet of cross-section paper by using one quadrant of rectangular co-ordinates. By the use of two quadrants the relations between four varying factors may be shown. The above formula contains four variables and hence two quadrants are necessary in making up a diagram for it. If the diagram is designed for using the ordinary scales of equal divisions, the lines showing the factors not represented by the axes are in general lines or curves radiating from a common point and as such have a limited range for a given accuracy and also a varying percentage of accuracy through their range. If, however, scales proportional to the logarithms of the variable factors are used, the lines which before radiated will be parallel straight lines with a greatly increased range in the same space and have an equal percentage of accuracy at all points of the range.—*Elec. Jour.*, June.

Electrophysics and Magnetism.

Electric Resistivity of Metals.—G. Niccolai.—By measurements of electric resistivity of metals it has been shown that the resistivity increases with temperature and that the temperature-resistivity coefficient for pure metals is between 0.0043 and 0.00327. Clausius has called attention to the fact that the average value is approximately 0.00366, which is also the temperature coefficient of the expansion of gases. The present author has tested the change of the resistivity of a few pure metals between white limits of temperature, extending from —200 deg. C. to + 400 deg. C. The chief results are given in Fig. 4, in which the abscissas represent degrees C. and the ordinates resistivity in absolute electromagnetic units. It will be seen that Clausius' statement is approximately true for only silver, gold, copper and platinum, while the other metals show large discrepancies. The rate of increase of resistivity with increasing temperature increases with iron and nickel and decreases with platinum and silver. By extrapolation of the curves it follows that the resistivity of the pure metals will be zero or at least very low at absolute zero of temperature. For pure copper it seems that the resistivity would become zero even before the absolute zero point of temperature is reached. The ratio of the resistivity of nickel at + 400 deg. C. to that at — 189 deg. C. is somewhat higher than 26; for iron it is higher than 16; for platinum it is higher than 7, and this is the smallest value for all the metals which were investigated by the author.—*Phys. Zeit.*, June 1.

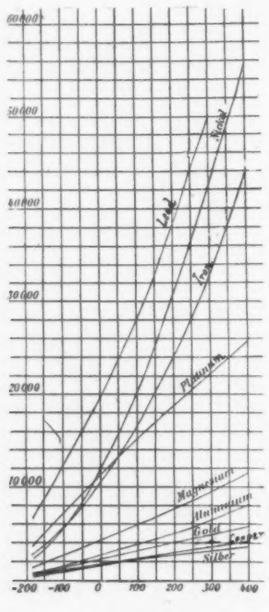


FIG. 4.—RESISTIVITY OF METALS.

Active Deposits.—S. Russ.—An account of an experimental investigation of the electric charge of the active deposits of actinium, thorium and radium. In dry air at atmospheric pressure the active deposits is chiefly confined to the negative pole, although to a different extent with different radioactive substances. By reducing the pressure, however, a marked diminution in the amount transmitted to the negative pole is observed, and some of the active deposit is directed to the positive pole. It seems that the electrical charge exhibited by the active deposit particles of the radioactive substances is determined mainly by the numerous collisions between these particles and the ions or molecules of the gas with which they are mixed. Whether the active deposits are electrically charged at the moment of formation from the emanations, still remains an open question.—*Phil. Mag.*, June.

Vacuum Tube.—H. A. Perkins.—A description of a rectification effect observed in a vacuum tube. It was noticed that a tube exhausted to about 0.5 mm pressure showed ionization when acted on by an alternating electrostatic field of low frequency and comparatively low potential, 550 volts and above. Moreover, a direct current passed through a galvanometer connected to two terminals sealed into the ends of the tube. The author gives a mathematical theory to explain the chief effects observed.—*Am. Jour. of Science,* June.

Radium Emanation.—P. B. Perkins.—The author describes a determination of the molecular weight of radium emanation by the comparison of its rate of diffusion with that of mercury vapor. His experiments leave little doubt that the molecular weight of radium emanation is greater than that of mercury vapor (200). Although the actual value obtained (235) is larger than the atomic weight of radium (226.5), yet the uncertainties of the diffusion method render it likely that this is due to experimental errors. It is, however, evident that the emanation has an atomic weight in the immediate neighborhood of radium—a result to be expected, on the disintegration theory, but which previous diffusion experiments had not confirmed.—*Am. Jour. of Science,* June.

Life of Radium.—B. B. Boltwood.—An account of an experimental investigation. The results obtained on the increase of radium in preparation of ionium separated from uranium minerals indicate that the half-value period of radium is about 2000 years.—*Am. Jour. of Science,* June.

Electrochemistry and Batteries.

Electric Steel Furnaces.—The first part of an illustrated series on the various types of electric iron and steel furnaces. In the present installment the furnaces of Stassano, Héroult, Keller, Harmet, Girod, Gin, Ruthenberg, Lash and Igewsky are dealt with.—Lond. *Eng'ing,* June 5.

Switchboard.—L. J. Borie.—An illustrated description of a switchboard for an electrolytic assaying office.—*Jour. of Elec., Power and Gas,* June 6.

Units, Measurements and Instruments.

Alternating-Current Arc as Frequency Changer.—W. Peukert.—Not only the direct-current arc, but also the alternating arc can be used as a frequency changer by combination with a condenser of proper capacity. The arrangement is shown in Fig. 5. The alternating-current arc is produced between homogeneous

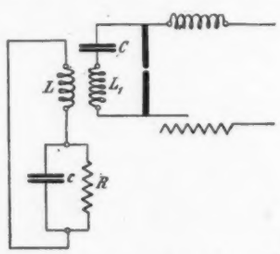


FIG. 5.—DIAGRAM OF ARRANGEMENT.

carbon electrodes by means of a 50-period sinusoidal alternating current, in parallel with an inductance coil L_1 and a condenser C with paraffin paper as dielectrics. To measure the frequency of the produced high-frequency current the author uses his method formerly described in the Digest. The inductance coil L (in series with a non-inductive resistor R and a condenser c, the latter two being in parallel) is suspended on a balance, and the equilibrium of the balance is reproduced by varying R and c. In this case the condition of resonance is fulfilled and the frequency can be easily calculated from L, R and c. Experiments of the author have shown that the alternating current arc can be maintained constant more easily for a

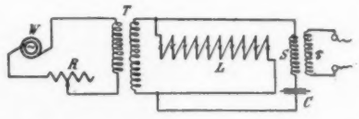


FIG. 6.—ARRANGEMENT OF SEVERAL ARCS.

considerable time than a direct-current arc. The smaller the capacity of C the higher is the frequency produced. In order to use large amounts of energy in the oscillating circuit, several alternating-current arcs are connected in series. This possibility is another advantage of the alternating-current arc. Conditions may be further improved by partial exclusion of air from the arcs or by operating them in illuminating gas or in a hydrogen atmosphere. The arrangement of several arcs is shown in Fig. 6, where W represents an alternator of 50 periods, the e.m.f. being raised to 3000 volts by the transformer T. A series L of 10 arcs in parallel with an inductance coil S and condenser C of about 0.04 microfarad. By coupling the coil S with the coil s of more windings it is possible to produce high-frequency high-tension discharges for special experiments. Instead of the alternating-current arc it is also possible to use a Geissler tube filled with hydrogen.—*Elek. Zeit.*, June 4.

Mercury Interrupter.—J. REYVAL.—A description of a new mercury interrupter (Fig. 7) recently shown at the exposition of the French Phys. Society in Paris. Contact is made between mercury emitted from the terminals of two revolving glass arms B and four nickel plates E arranged symmetrically within the cylinder R. A supply of mercury is provided at the bottom of the cylinder, and by revolving the central axle A_x the mercury is driven up into the arms B and emitted from the ends. Since there are four nickel plates E, there are four interruptions per revolution. A non-oxidizing atmosphere is provided by passing illuminating gas through the apparatus. It enters through A and leaves through A^1. The apparatus will operate satisfactorily for a very long time since there is no possibility of the mercury being oxidized or spoiled by impurities. —*La Lumière Elec.*, May 30.

Measuring Electric Conductivity.—R. APPLEYARD.—An illustrated article in which the author summarizes the principles

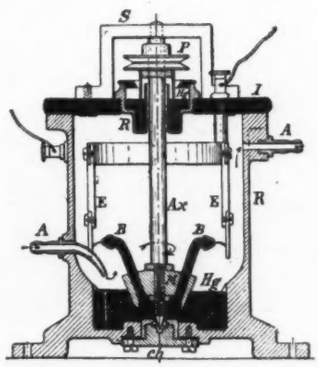


FIG. 7.—MERCURY INTERRUPTER.

which he has found useful in the design of direct-reading instruments for measuring electric conductivity, especially for submarine cables, etc. Instruments intended both for a comparatively short and for an extensive range of conductivity are discussed.—*Brit. Lond. Elec. Rev.*, June 5.

Automatic Photometer.—C. FERY.—Most photometers are "ocular," meaning that comparisons of brightness are made by the eye. To eliminate this necessity, it has been proposed to employ a selenium cell, a bolometer, or other instrument sensitive to radiant energy. All such instruments, however, suffer from the drawback that their color-sensitiveness is not the same as that of the human eye. This might be rectified by analyzing the light spectroscopically and decreasing the various radiations in the requisite proportions. Fortunately, however, the same result may be obtained in a much simpler manner by a screen consisting of a solution of acetate of copper. Mr. Fery proposes to employ such a screen for the automatic recording of luminosities. The maximum sensitiveness of the eye is at a wave-length of 540 $\mu\mu$, which is therefore the brightest region of the spectrum. It is only necessary to graduate the strength and thickness of the solution in such a manner that the recording instrument shows the maximum reading at that wavelength; then the color-curve is the same as that of the human eye. As a recording instrument, Boys' radiomicrometer is most suitable. It is sensitive enough to record to from 0.1 to 0.4 per cent of light transmitted by the solution, and gives a deflection of 60 mm per candle at 1 meter.—*Bulletin 278* of the French Phy. Soc'y, abstracted in Lond. *Elec. Eng'ing*, May 21.

Dielectric Constants.—V. H. VELEY.—A note on a Faraday Society paper on an apparatus for the determination of dielectric constants of non-conducting liquids. In the usual bridge method balance is obtained by varying a resistance. In the author's apparatus the capacity of a condenser is varied in such a way that variations are proportioned to the distance traversed by the movable condenser plate. These are read off directly, and a simple calculation gives the specific inductive capacity under measurement.—Lond. *Elec.*, June 5.

Wattmeter.—The conclusion of the very long illustrated description of the precision wattmeter of the Siemens-Schuckert Company, with notes on its application for various purposes.—*Zeit. f. Beleucht.*, May 20.

Telegraphy, Telephony and Signals.

Telephone Poles.—P. M. PAINE.—An illustrated article recommending the use of the so-called "inferior" timbers for telephone poles, which are very useful if properly impregnated. Much is still to be done in determining the best preservatives, manner and depth of injection, and height of pole that should be treated.—*Am. Tel. Jour.*, June 6 and 13.

Automatic Telephones.—A. B. SPERRY.—An illustrated description of the Keith line switch, which is the latest improved arrangement of the first selector switches for automatic telephone lines.—*Am. Tel. Jour.*, June 6.

Miscellaneous.

British Patents in 1907.—An abstract of the report of the British Comptroller-General of Patents for the year 1907. Although the number of applications was somewhat less than in 1907, the number of patents sealed in 1907 was 16,272, against 14,707 in 1906. Those classes which have been particularly active, include electric telegraphs, "conducting electricity," electric lamps, electrolysis, signaling, aeronautics, air and gas engines, and rotary engines. Out of the 16,272 patentees in 1907, 2792 reside in the United States and 2608 in Germany. The number of British patents which expired in 1907 was 14,470.—Lond. *Elec.*, June 12.

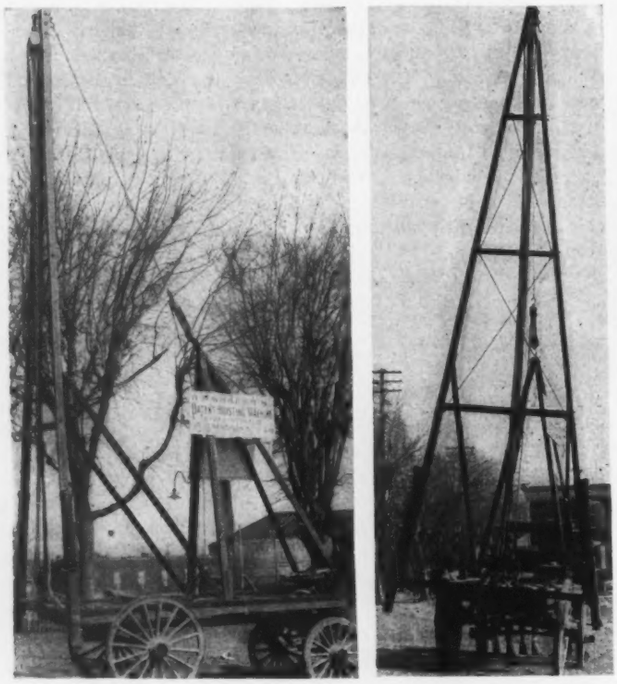
Electric Porcelain.—H. W. BRADY.—The first part of an illustrated paper read before the Birmingham and District Electric Club on the manufacture of porcelain for electric purposes (insulators, etc.). The author discusses the raw materials which enter into the manufacture, and describes the different steps of manufacture as carried out in England. The paper is to be continued.—Lond. *Elec.*, May 29 and June 5.

Paris Exposition—J. REYVAL.—The first part of an illustrated description of various exhibits of laboratory instruments and apparatus at the recent exposition of the French Phys. Soc'y in Paris.—*La Lumière Elec.*, May 23 and 30.

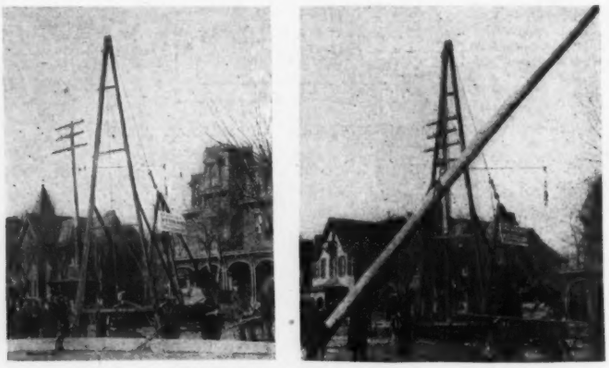
NEW APPARATUS AND APPLIANCES

Pole-Erecting Apparatus.

The accompanying illustrations show the application of a pole-raising and pole-lowering machine invented by Mr. Benjamin F. Shafer and marketed by W. N. Matthews & Brother, of St. Louis, Mo. The inventor of the machine was for many years in the pole-line construction business, and prior to that was identified with the construction department of one of the large telegraph companies. The machine illustrated is said to embody all the essential details which have been gathered by an experience gained in the erection of poles for a period of over 35 years. The pole-hoisting machine consists of a triangular derrick and apparatus for its control, which may be mounted on any dray or heavy work wagon. A good general idea of the machine may be obtained from Figs. 1 and 2. When it is necessary to pass under trolley wires, bridges or other aerial obstructions, the derrick may be lowered as shown in Fig. 5. At the lower ends of the triangular mast are two extension legs or supports which are let down to the ground when a pole is to be lifted. The weight is thus transferred from the wagon to the ground. The pole-hoisting machine is designed to handle poles as long as 75 ft., and can be operated by two linemen and a driver for the team of horses. The arrangement can be knocked down for convenience in shipping and weighs, it is said, 700 lb. crated. In a test made at Media, Pa., by the Bell Telephone Company of Pennsylvania, the machine was mounted on a four-wheel truck and stationed with the team facing away from the hole at a distance of 135 ft. When the signal was given the driver and two regular linemen mounted the wagon, turned it around, drove to the pole to be set and planted it in six minutes after the start was made. The illustrations show the various steps in the erection of a 51-ft. chestnut pole. The machine was also used for removing 50-ft. to 65-ft. poles from the streets of Media. These poles, it is said, were pulled bodily out of the ground after the linemen had dug through the frost line. Twenty to 24 poles were removed each working day of nine hours. The designer of this machine claims that it saves from 35 to 60 per cent of the present cost of putting up new poles or taking down old ones. Poles can be handled much more rapidly and with greater safety than is possible by the old method.



FIGS. 1 AND 2.—TWO VIEWS OF POLE-RAISING APPARATUS.



FIGS. 3 AND 4.—POLE-RAISING APPARATUS IN USE.

FIG. 5.—PASSING UNDER WIRES ON BRIDGE.

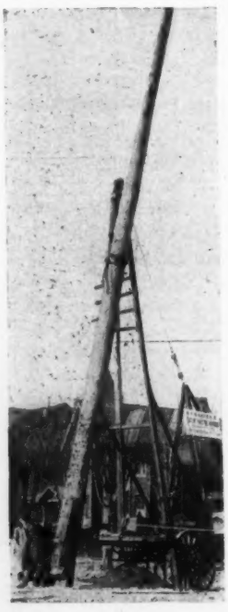
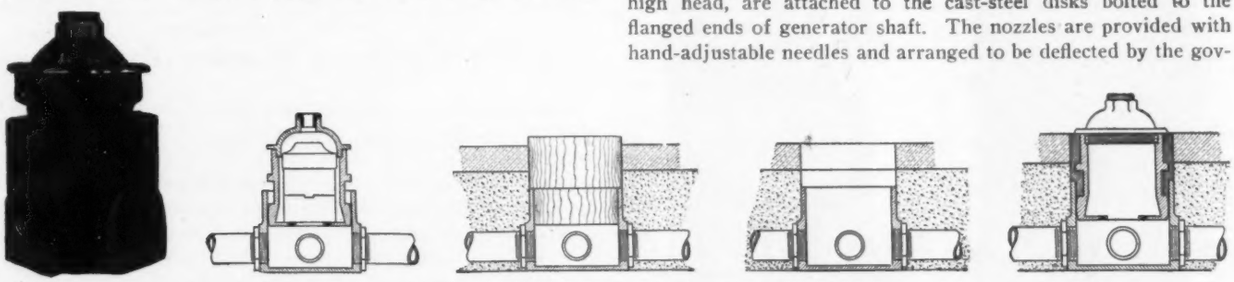


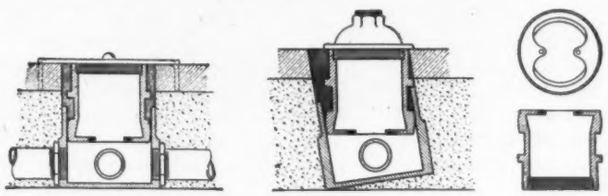
FIG. 6.—POLE RAISING.

"Quixet" Floor Box.

The J. Lang Electric Company, 116 North Lincoln Street, Chicago, has recently brought out a neat little floor box that, on account of the ease and rapidity with which it can be set, has been given the trade name of "Quixet." The general appearance of this box is shown in Fig. 1. Its height from the bottom to the floor level is 3½ in. and its diameter 2 5/16 in. The cup or box proper is of cast iron and has tapped holes, the conduit being screwed directly into these. Fig. 2 shows a cross-section of the box complete as equipped with a Hubbell receptacle and plug. Inside of the box or cup is inserted what is called a ball plug, also of iron, shown separately in Fig. 8, which can be placed at various angles with respect to the cup in which it fits, as shown in Fig. 7. Into the top of this ball plug either an outlet nozzle or a flat covering can be screwed. When this box or cup is first set, a rough wooden plug is inserted as in Fig. 3. The flooring material can then be placed around the plug by the flooring contractor; the concrete being filled clear up to the plug and box. When the wooden plug is taken out, as in Fig. 4, the box is ready for the insertion of the adjustable ball plug. This plug is inserted and a dummy leveling plug is screwed into the top, to hold the ball plug level with the floor while the space around the plug is filled with Portland cement or "smooth-on." The box then becomes really a part of the floor, and both box and floor are watertight. Figs. 5 and 6 show the box as complete with different fittings. Fig. 7 shows the adjustability of the box by virtue of the ball-and-socket action of the ball plug in the box or cup. The ball plug separate is shown in Fig. 8. Besides the dimension of the cup previously mentioned, the cups are made in other depths, making the distance from the bottom of the cup to the floor level either 3½ in., 4½ in. or 6 in. The box proper has only three parts, and there are no screws or gaskets. It is claimed by its makers to be not only lower in price, but less costly to install than other floor boxes.



FIGS. 1, 2, 3, 4 AND 5.—GENERAL VIEW AND SECTION VIEWS OF FLOOR BOX.



FIGS. 6, 7 AND 8.—FLOOR BOX.

Electricity in Building the Los Angeles Aqueduct.

The energy used in excavating, in driving tunnels and in hoisting materials up steep mountain sides during the construction of the 215-mile aqueduct supplying water from Owens River to Los Angeles, Cal., will be obtained from the mains of the Los Angeles Edison Company, whose high-voltage transmission lines transmit electrical energy 117 miles from the Kern River No. 1 generating station. A description of this station appeared in our issue for Aug. 24, 1907.

The four big wheels which convert hydraulic to electrical energy were built by the Allis-Chalmers Company, of Milwaukee. Each is rated at 10,750 hp at full nozzle opening and a speed of 250 r.p.m., when operating under a net effective head of 865 ft. In addition to the main turbines there are two exciter turbines, also of Allis-Chalmers design, each rated at 450 hp and a speed of 430 r.p.m. The turbine units are of the impulse type, with hand-adjustable needles and governor-operated deflecting nozzles. Each unit has two runners, one on either end of the generator shaft. The interchangeable buckets, which are made of non-corrosive phosphor bronze of special mixture for the high head, are attached to the cast-steel disks bolted to the flanged ends of generator shaft. The nozzles are provided with hand-adjustable needles and arranged to be deflected by the governor automatically, or by the latter's hand-regulating device. By deflecting the jet, instead of regulating its discharge by adjusting the needle with the governor, it is possible to secure a constant velocity of water in the pipe line, as well as a constant discharge of water into the tailrace, even when the plant is operating with heavy fluctuations of the commercial load.

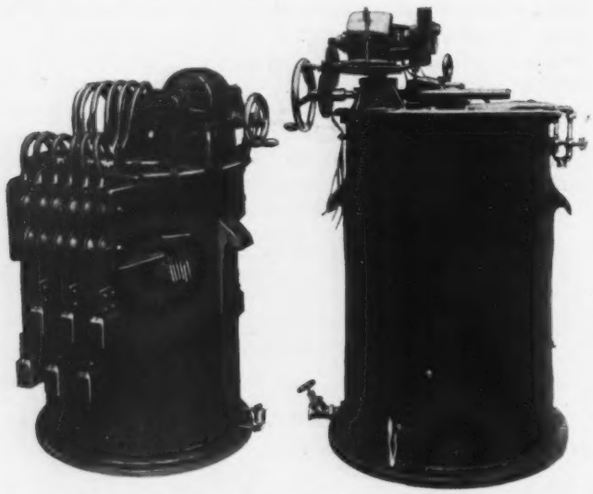
The Kern River installation of the Edison Company is one of three water-power developments owned by this company, in addition to six or seven steam plants located within a radius of 200 miles, all of which will operate in synchronism. A portion of the output of this plant is disposed of along the line to Los Angeles. A very considerable amount of power will be utilized in the city of Santa Barbara. The demand for power in Los Angeles, Santa Barbara and San Luis Obispo Counties far exceeds the supply, and the output from this station helps to satisfy the general requirements rather than being devoted to any specific purpose. The Edison Company contemplates the building of plants Nos. 2, 3 and 4 on the Kern River, which will aggregate over 100,000 hp in addition to the output of the present station.

Motor-Operated Induction Potential Regulators.

An induction potential regulator is a variable-ratio autotransformer, the delivered e.m.f. of which depends upon the position of a moving member with reference to a stationary member. It resembles an induction motor in general construction. Across the primary winding, which is placed on one member, the supply e.m.f. is impressed; across the secondary winding on the other member there is produced an e.m.f. which in the single-phase type is constant in time-phase, but varies in value with the relative positions of the two members, and in the polyphase type is constant in value, but varies in time-phase with the mechanical position of the moving member. The vector sum of the primary and secondary e.m.f's. is the e.m.f. delivered by the regulator.

In the polyphase regulator illustrated herewith both the primary and secondary elements are wound with as many sets of coils as there are phases in the circuit. These windings are distributed throughout the complete circumference of the cores and closely resemble the windings of an induction motor. Fig. 1 illustrates a six-phase, air-blast cooled induction potential regulator for use with a six-ring synchronous converter. Fig. 2 gives an excellent view of the small motor that is employed for rotating the movable member into the position necessary to provide the required change in the delivered e.m.f. Even during normal operation considerable torque is exerted by the rotor and under short-circuit conditions the torque becomes

enormous. Hence, the device for moving the rotor into the desired position and holding it there must be liberally proportioned. The rotor is moved by means of worm-gearing which normally is motor-operated, but can be worked by hand.

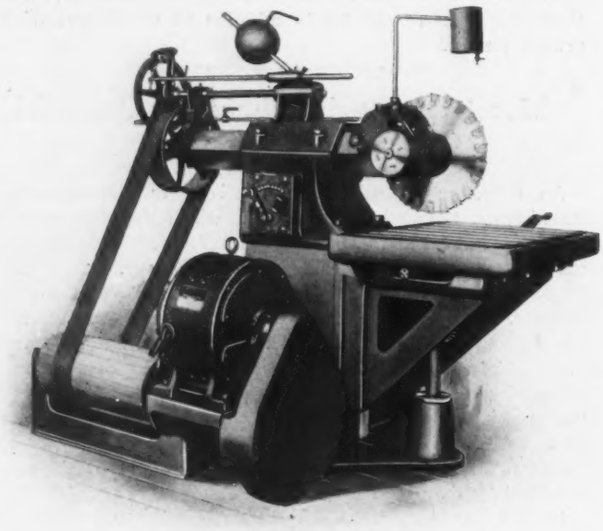


FIGS. 1 AND 2.—POLYPHASE MOTOR-OPERATED POTENTIAL REGULATOR.

These regulators have been placed on the market by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

Cold Saw.

The changes which are taking place in machine tools at the present time have the object of greater production with greater ease of control. A majority of these changes are due to the adoption of electric motors for the driving power. The accompanying illustration shows a very good example of the latest development of the Wagner cold saw, manufactured by the Birdsboro Steel Foundry & Machine Company, equipped with a Westinghouse type "S," direct-current, semi-enclosed, constant-speed motor. The method of mounting makes a most



ELECTRICALLY-DRIVEN COLD SAW.

compact unit, which can be located at any convenient point in the shop. The cross feed of the work table, in connection with the vertical movement, enables the work to be brought up to the saw without blocking, except enough to level the casting. This saw is especially designed for small work, such as cutting off sink heads, and may also be used for cutting mitres or bevels, as the head may be turned through any angle desired. Where the degree of hardness of the material to be cut varies considerably, the peripheral speed of the saw must also be varied. For this purpose variable speed motors are supplied, permitting the speed to be reduced when cutting high-carbon steel.

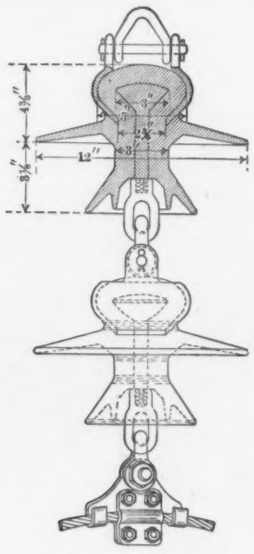
A large type of cold saw is also manufactured by the same company, which is built in several sizes up to a 50-in. saw, capable of sawing through a 16-in. rod. These saws are supplied with motor drive, with a chain or belt connection, or may be geared direct if desired. The adoption of an individual motor for each saw secures to the fullest extent the economies and advantages of electric drive, as the machine is run only when in use and hence consumes no power from running idle.

Non-Polarizing Primary Battery.

The Hite Electric Company, 305 South Second Street, Philadelphia, has placed upon the market a type of primary battery which possesses many interesting features. Mechanically considered, the battery is constructed of a wooden box coated on the inside with a waterproofing compound, which is divided into compartments by plates of carbon, which form the positive electrodes of the cells of the battery. The negative electrodes are of zinc sheets entirely submerged in the electrolyte. A depolarizer in tablet form is used in the electrolyte. It is claimed that the battery does not polarize, and that crystals do not form on the zinc electrodes. Moreover, the arrangement is such that a high e.m.f. (12 volts or less) may be delivered from a single self-contained battery having no inter-cell connections, the only variable contacts being those at the two terminals. As showing the compactness, it may be stated that a 12-volt battery complete measures only 7 in. x 7 in. x 12.5 in. The batteries are built in four ratings, for 4, 6, 8 and 12 volts, respectively.

Flexible Suspension Insulator.

The accompanying illustration shows a suspension type of high-voltage insulator which is claimed to possess many desirable features. Between the two units, and between each unit and the structure which it supports, or from which it is suspended, there is provided a universal joint which allows absolute freedom of movement. Thus the insulator as a whole is



SUSPENSION INSULATOR.

entirely flexible and no portion of the dielectric is subjected to unnecessary mechanical stress. However, the units have been designed with special reference to mechanical stresses, it being estimated that a tensional force of 20,000 lb. can be withstood. Mechanically considered, the unit is built up of a central bolt ¾ in. in diameter, having a conical head, 3 in. in diameter. External to this head and separated from it by 1-in. thickness of "Electros" insulation is an outer cylindrical bell having such

dimensions that it cannot part company with the central bolt even though the insulating material were totally destroyed.

The dimensions given above refer to an insulator having a hood 12 in. in diameter, each unit being capable of withstanding an electrical pressure of from 35 to 40 kilovolts, and the insulator as a whole is designed for 60,000-volt circuits. It has been selected for use at this voltage by the Indiana Steel Company. It is interesting to note that each element of this insulator is practically identical with the 12-in. insulators employed exclusively on the Niagara-to-Buffalo transmission line of the Canadian Niagara Power Company, which company recently placed an order for 900 additional insulators of the same type.

The above-described insulators are designed and built by the Electrose Manufacturing Company, 127 North Tenth Street, Brooklyn, N. Y.

New Nernst Lamp Holder.

The Nernst Lamp Company is putting on the market a new type of holder for use in connection with multiple-glower lamps, to be known as the "Wafer" holder and characterized by great simplicity of design. The part from which it gets its name takes the place of the heater tubes used with the older holder and does away with the use of the heater porcelain entirely. The

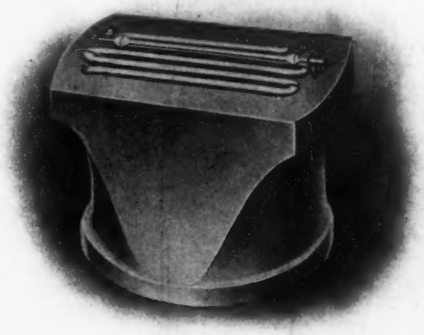


FIG. 1.—NERNST LAMP HOLDER.

wafer consists of a long thread of heater material wound back and forth over the surface of a porcelain base and firmly attached to it by means of wires. The wafer is secured in position by two wire prongs, which at the same time serve as terminals, to which it connects automatically. The holder porcelain is provided with a groove to admit the wafer. The wafer can be changed in a moment's time. It requires no instrument for

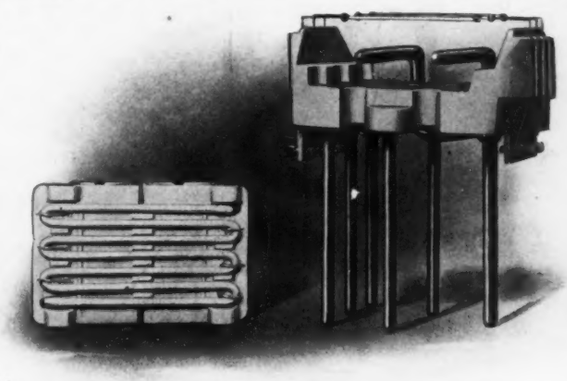


FIG. 2.—NERNST LAMP HOLDER.

its removal, and the operation can in no way injure or interfere with the glowers or connections.

Since the testing and replacement of heater tubes has always been one of the chief items in the maintenance of Nernst lamps, the labor required to maintain them will, through the use of the new holder, be greatly reduced. Likewise the cost of maintenance will be reduced since the heater porcelain will not have to be considered, and there is no possibility of glower breakage through handling of heaters.

The successful development of this heater permits of a non-renewable holder for single-glower units, employing horizontal glowers. The use of such a renewal in the single-glower units simplifies the maintenance, as no mounting of heaters and glowers is required; in fact, the trimming of the single-glower lamp is similar to that of incandescent lamp systems, except that the renewal is "pushed" into place instead of being screwed into place.

Show Window Lighting by Means of Tungsten Lamps.

The accompanying photograph gives a night view of the Second District office of the New York Edison Company, at 124 West Forty-second Street. The company occupies the entire building. The upper floors are to be utilized as offices, while the ground floor is to be devoted solely to purposes of display. The exhibit upon this floor will include electrical apparatus of almost every description, and will serve to demonstrate how electricity may be made to do almost everything, from turning the wheels of a factory to lighting a cigar. Practically every type of electric lamp now in use will be on exhibition, so that the prospective user of electric light may be in a position to make a direct comparison between the different electric illumi-

WINDOW LIGHTING WITH TUNGSTEN LAMPS.

nants, and to choose that one which is best suited to his or her particular requirements. This display room is to be kept open every day, except Sundays, between the hours of 8 a. m. and 12 midnight, and representatives will be in attendance at all times ready to answer any inquiries in regard to the manifold applications of electricity.

The front windows of this display room have been equipped

with tungsten lamps, and the illumination resulting from this installation is without question greater in amount than any ever before obtained in show-window lighting. The ceiling above the two windows and the entrance has been studded with a total of 80 100-watt lamps. Each lamp is equipped with a prismatic reflector which concentrates the light directly beneath the lamp, thereby securing 650 downward candle-power from each 80-cp lamp. The total downward candle-power in each window is in excess of 25,000 and the illumination at the bottom of each window is 100 foot-candles, as shown by a recent illuminometer test. When it is remembered that one to two foot-candles is a very satisfactory illumination for ordinary reading, and that 10 foot-candles is probably the maximum illumination ever required, even where the most exacting work is carried on, such as etching and draughting, the figures given above will convey some idea of the intensity of the illumination in these windows.

Outside of the quantity and quality of the light from the installation, the lighting is particularly effective on account of the fact that the sources of light are completely concealed from the eyes of the passerby. This is a very necessary condition so far as the effective displaying of goods is concerned; for if bare lamps of high intrinsic brilliancy are placed in the field of vision the ability of the eye to discern any neighboring objects is materially lessened. That this fact is not generally recognized is very evident from an examination of the methods employed in lighting the average show windows. The New York Edison Company has set an excellent example in demonstrating the proper methods to be followed in this class of lighting.

As a means of advertising the value of such a display is already very apparent. With absolutely no other attraction at present than an extremely brilliant, scientifically lighted window, the attention of every passerby on either side of the street is instantly attracted, and it is safe to say that more people are stopping each night in front of this window than before any other window in the city of New York. This result is being accomplished without any attempt at window display, the only attraction being the wonderful illumination. This should open the eyes of those merchants who have show windows located upon prominent thoroughfares to the great possibilities which exist in this form of advertising. The lesson which this window teaches will not be lost upon certain enterprising merchants, and a higher standard in show-window lighting will probably be the result of this remarkable demonstration, particularly now that the tungsten lamp has so largely reduced the cost of lighting by electricity.

Electric Heating Devices.

Three patents were granted to William S. Hadaway, Jr., on June 16 covering various electric-heating devices. Fig. 1 shows a sadiron comprising an ironing plate, the body and a resistance unit. The last consists of a notched insulating plate around which a resistance ribbon is wound in the form of a flattened helix. The insulating plates are made up of sheet mica held together with suitable insulating shellac in order that the plates may soften under heat and pressure applied in assembling, and thereby act as a gasket to equalize the pressure. The resistance ribbon is provided with a plurality of lateral slots which are alternately opened at opposite sides to produce a zig-zag path, whereby a considerable length of conductor is obtained in a relatively short length of ribbon. The slots are omitted from the ends of the ribbon and from portions which are bent in the formation of the flattened helix so as to obtain the maximum conductivity at places which would otherwise tend to fuse in the operation of the unit. The resistance unit and one of the insulating plates are shown at the left of the engraving.

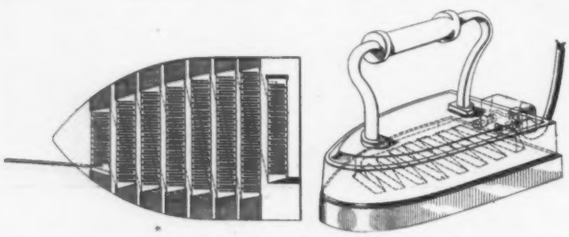


FIG. 1.—ELECTRICALLY-HEATED SADIRON.

In the manufacture of bonbons it is desirable to immerse the vessel containing the sugar in water and in order to obtain the required heat for melting the sugar in the quickest time and maintaining the material at substantially the same temperature for an indefinite period and with a minimum expenditure of energy, the arrangement shown in Fig. 2 is employed. The outer receptacle has an inlet port and an overflow pipe. The second vessel is supported within the outer vessel, and the third or inner vessel is suspended within the second receptacle. The latter is provided with a double wall and a double bottom. The inner vessel is provided with a flange which projects laterally over the rim of the outer vessel and serves as a support. A plurality of studs project downward from the flange and under normal conditions engage holes in the rim. Electric heating coils are wound one over the other adjacent to the inner wall within the fluid-tight compartment of the intermediate vessel. The leads of the coils are connected to terminals which project through the bottom plate and are disposed within a short length of pipe so that the circuit connections can be varied from without. In operation, water is placed in the outer vessel to a level slightly above the top of the intermediate vessel. In order to melt the material in the inner vessel rapidly the vessel is raised and supported by the studs, thus lowering the level of the liquid in the pot below the edge of the intermediate vessel. Energy is then supplied to the inner heating coil, which is preferably connected across the line at this time, and the heat thus generated is transmitted directly through the conducting wall of the intermediate vessel. The volume of water in this vessel is relatively small so that its temperature soon reaches the boiling point. As soon as the sugar is melted the inner vessel

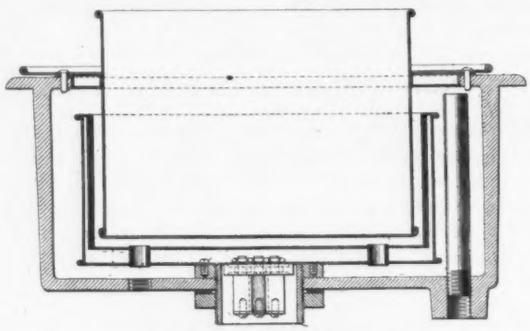


FIG. 2.—ELECTRICALLY-HEATED BONBON KETTLE.

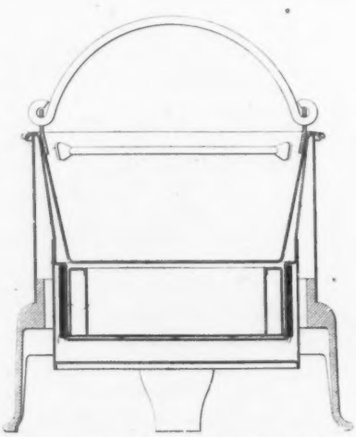


FIG. 3.—ELECTRICALLY-HEATED GLUE POT.

is lowered to its normal position, thereby raising the water in the outer vessel above the intermediate vessel and permitting a free circulation of the liquid. The heating coils are then connected in series so that less energy is supplied to them and the sugar will be maintained in a molten condition without danger of burning.

The glue pot illustrated in Fig. 3 contains a relatively large amount of water, and, at the same time, a small portion of the water is quickly heated to a high temperature and carried against the walls of the inner vessel in the form of steam. The heating coils surround the cylindrical projection as shown and in order that the heat generated may be conducted through the projection in the water, a drum is fitted over the lower end of the vessel containing the water in such a manner as to form an annular heat insulating air chamber. The receptacles are fitted so that an annular steam chamber is provided between the walls of the two receptacles, and a relatively large water reservoir is provided below the inner receptacle. The heating coils to which energy is supplied initially is secured directly to the projection and the other coil which is in service under normal conditions is bound over the first coil. The use of ribbon resistance strips wound helically about the outer surface of the chamber and insulated from it by mica is recommended as being the preferable arrangement.

Exhibits at Railway Telegraph Superintendents' Convention at Montreal.

Several manufacturers had interesting exhibits of apparatus at the convention at Montreal last week of the Association of Railway Telegraph Superintendents.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., showed a complete working system for dispatching trains by telephone, including a selective signaling alarm system, with an answer-back device to record the signaling of the station called at the dispatcher's office.

THE HOMER ROBERTS TELEPHONE COMPANY, Chicago, Ill., had a selective dispatching telephone system which attracted considerable attention. By this system stations may be rung selectively while the control of the line is secured to the dispatching office.

THE SANDWICH ELECTRIC COMPANY was represented by its engineer, Mr. H. O. Rugh, who showed the Sandwich selector and telephones for selective signaling dispatching circuits.

THE WESTERN ELECTRIC COMPANY had special exhibits of selective dispatching apparatus, telephones and all equipment necessary for dispatching circuits and other railway uses.

AMONG other manufacturers represented were the Duplex Metals Company, New York; J. H. Bunnell & Company, New York, and W. R. Brixey.

Storage Battery Rheostat.

In the Ward Leonard type rheostat, shown herewith, there are several switches in parallel, each switch controlling its respective resistance. Each resistance is designed to carry the maximum amperes that can be passed by the charging voltage

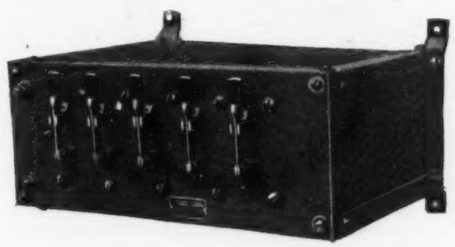


FIG. 1.—GARAGE RHEOSTATS.

with the rheostat in circuit. To secure any charging amperes within the rating of the rheostat, it is merely necessary to close the proper switches. There are five switches giving 31 steps of control. Each switch is marked with the approximate amperes that will pass when it is closed and all the other switches are open. By reading the switch markings, the approximate charging amperes are got at a glance. An overload through the circuit is thus avoided, and the cells thoroughly protected from abuse.

The resistance elements are the standard Ward Leonard enameled resistance units. They are fireproof, strong and light, and thoroughly protected against chemical, electrical and mechanical depreciation. Any rheostat of the present type, designed for a minimum number of cells, can be used to charge a greater number of cells, but at a slightly decreased charging rate.

FIG. 2.—RHEOSTAT WITH SWITCH AND FUSES.

Twelve cells are the minimum number used in electric carriages. Therefore, the minimum battery volts are approximately 24. Twenty-four volts opposed to 120 volts of a line circuit leave 96 volts to be used up in the rheostat. For pleasure carriages 40 amp are the maximum charging amperes. A rheostat as described, for 12 cells and 40 amp charging rate, has each switch and its resistance designed to be connected across 96

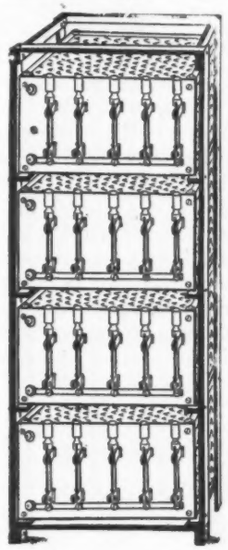


FIG. 3.—STORAGE BATTERY RHEOSTAT.

volts, and when all the switches are closed 40 amp will pass through the circuit. Such a rheostat can be used to charge the following number of cells at the following charging rates:

12	cells	in circuit,	maximum	charging	rate is	40 amperes
24	cells	in circuit,	maximum	charging	rate is	38 amperes
30	cells	in circuit,	maximum	charging	rate is	28 amperes
36	cells	in circuit,	maximum	charging	rate is	22 amperes
40	cells	in circuit,	maximum	charging	rate is	18 amperes
44	cells	in circuit,	maximum	charging	rate is	15 amperes

Fig. 1 shows the rheostat as described, Fig. 2 shows the same rheostat with a line switch and fuses added, making a complete installation, and Fig. 3 a bank of rheostats for garage service.

Indicator Reducing Motion.

Many methods have been devised for reducing the motion of an engine cross-head for indicator mechanisms. Recently Messrs. F. H. and F. O. Ball, of the American Engine Company, Bound Brook, N. J., have patented a reducing motion, which, while it is used on the company's new engines, is applicable to Corliss or other types of reciprocating engines. From the

illustrations it will be seen that the device consists essentially in a slotted plate through which moves an L-shaped lever. At the elbow this lever is pivoted through a bolt, at the apex of a triangular-slotted plate cast as one with the outer plate of the device, and at right angles to it. The short arm of the L-shaped lever is forked. In the fork is set a small wheel. Also connected with this arm is a pin which works through and at right angles to the outer plate. A helical spring, pressing against the outer plate, and a disk resting on the shoulder of the pin, constantly tends to maintain the L-arm at the extreme end of the slot. The device is fastened by bolts to the frame of the engine. On the cross-head is secured a cast-iron cam plate set at an angle in the vertical plane with the lower end directed away from the cylinder and at such an angle that the lower or front end is 2 in. below the rear end. The angle of this cam plate

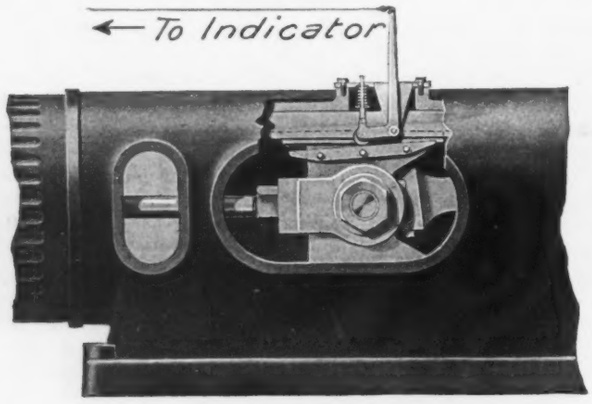


FIG. 1.—INDICATOR REDUCING MOTION.

is determined by the length of the stroke of the engine, so that the same difference in height between the front and rear ends of the plate will be maintained in all cases. When the cross-head is in position nearest the cylinder the lower end of the cam plate is in contact with the wheel at the lower end of the L-arm, and as the cross-head travels forward this wheel with its arm is raised in exact proportion to the piston travel against the pressure of the spring; the reverse taking place as the cross-head returns. The strength of the coiled spring is said to be sufficient to prevent any lost motion with this device, even in a

FIG. 2.—INDICATOR REDUCING MOTION.

high-speed engine. The adjustment of the cam plate can be so arranged that the travel of the upper end of the L-arm is exactly that desired to turn the indicator cylinder the required distance without further reduction. On top of the exterior plate is a small flat trigger or lock which engages with a slot milled into the pin working in and out through the plate. Thus when the pin is pushed to its extreme top position, the trigger can be slipped into the slot and the rig instantly thrown out of engagement. The only visible portion of the mechanism is a polished oblong metal plate on the engine frame with a slot through which projects a 6 in. or 7 in. lever with a hole in the top for the indicator cord.

Improvement in Stoker Construction.

The accompanying illustrations show the new model of Roney stoker, the most important feature of which is the sectional grate bar. For the upper four grates use is made of a non-sifting type of top provided with abutting horizontal ledges to prevent the fine fuel from sifting through the bars, and at the same time to permit a free entrance of air. The grate proper consists of a number of thin plates set on edge in V-shaped grooves; these hook over a trussed webb, and being held in

FIG. 1.—DETAILS OF SECTIONAL GRATE BAR.

place by a key-rod slipped in from the end, are easily removed. The shape of the grate elements is such that for each square foot of surface exposed to the fire there are 7.4 sq. ft. of surface cooled by the entering air, hence the cooling effect is very pronounced and the life is long. Moreover, the grate-bar tops can be redistributed at any time in order to equalize the deterioration in various parts of the furnace, while when the grate-bar

FIG. 2.—CONSTRUCTIONAL DETAILS OF STOKER.

tops are to be discarded there is a minimum amount of scrap. It is stated that the new model stoker possesses such decided advantages over the older type that many plants equipped with the latter are voluntarily substituting the former for it. The Roney stoker is built by the Westinghouse Machine Company, East Pittsburg, Pa.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Trade has taken on the usual midsummer dulness during the last week. Conditions, however, are not desperate and there is every reason to look for a great revival in the fall. During the week the weather conditions in the Southwest have improved materially, and harvesting has progressed. Corn, cotton and spring wheat have improved visibly and the promise of abundant yields is even more flattering than at the time of previous reports. There is every reason now to predict large crops. Retail business has been helped by warm weather in most sections and by widespread reduction sales. Jobbing houses have received moderate filling-in orders and have made the clearance sales that are customary at this season of the year. Buying for fall has been cautious, but more traveling salesmen are on the road and the feeling with regard to the future is distinctly optimistic. Agricultural implements and a few lines of steel products are more active, but the output of the great industries as a whole is below the normal. Farm products, notably cotton, the cereals, fruits and vegetables, have moved to rather lower levels on the better crop reports. Climatic conditions, lack of purchasing power and increased receipt of grass-fed animals point to lower prices for meats. The railroads of the country are making preparations for crop moving. Car repairing material is being taken more liberally and the iron and steel industries feel the benefit of this movement. Manufacturers of harvesting machinery report good sales; in fact, all machinery makers are reporting more orders than they did a few weeks ago. Some money is leaving Western centers for the interior, but there is still a plethora of funds seeking investment, commercial demand is dull, and rates over the July 1 dividend period were low. Collections are no better than fair at any center and slow as a rule. Bank clearings for the week are smaller than in the previous week and the corresponding week of last year, both at New York and in the country outside the metropolis. Railway earnings for June indicate a decrease of about 18 per cent, as against a decrease of 23 per cent in May. Summer travel is larger, and comparisons are now with decreasing totals a year ago. In the West the yield from the fields is large, although in some sections it not up to the estimates of early promises. The winter wheat harvest in Kansas will probably total 10,000,000 bushels more than last season, and the returns from Oklahoma indicate the greatest yield recorded there. Sentiment in iron and steel trades is optimistic, although actual orders are not sufficient to signify any decisive turn. A heavy demand for supplies is expected from the railways before long. Pig iron has been fairly active in the East at reduced prices, while in the West quotations have been held firmly and business has been light. Copper is easier, and there is some pressure to sell. According to *Bradstreet's* report bank clearings for the week ending June 25 aggregate $2,063,442,000, 4.6 per cent under the preceding week and 14 per cent below the corresponding week of last year. Outside of New York the total is $878,961,000, a loss of 6.8 per cent from the previous week and of 17 per cent from the corresponding week of last year. Business failures for the week ending June 25 number 258, which compares with 254 in the previous week, 150 in the corresponding week of 1907, 146 in 1906, 186 in 1905 and 204 in 1904.

THE COPPER MARKET.

The pressure to sell in the copper market was distinctly more apparent last week than has been noted recently. An unusually small amount of metal has been sold for July-August delivery, and consumers seem to be totally out of the market; under these conditions prices could not be expected to remain rigid. Quotations on the New York Metal Exchange receded fractionally during the week, and were from ¼ to ½ cent lower on June 29 than one week previous. In addition, it might be stated that there was more disposition among producers to make concessions where a buying inquiry developed, and that the whole tone of the market was weaker. In spite of many denials it is generally believed that the accumulation of unmelted copper in Europe is heavy. The heavy supplies and the tendency toward further accumulation, because current consumption is running behind current production, have led to liquidation on contracts in standard warrants in Europe, and this situation has brought about a decline in refined metal. The offerings of electrolytic copper in London are still far above the actual demand, and it is admitted that such copper can now be bought for £59 in the open market, which is equivalent to 12.05 cents in New York. Of the general situation, the National Conduit & Cable Company says in its circular: "Moderate trading but gradual recuperation in business appears to represent the facts of the case as we find them in the general business situation of the country. Market interest and inquiries for copper have increased considerably recently, and more business has resulted. The actual movement represents a fair number of moderate-sized orders, the placing of which gave a firmer tone to the situation. It cannot be said, however, that conditions in manufacturing quarters disclose very much change in the character of consumption, although it is probably the case that business is showing gradual improvement. It is still a fact that buying is largely of the hand to mouth variety as large projects are too few to encourage stocking up heavily with raw material. The production of copper is again at a low level where this country must absorb it more freely if the market is to be maintained on a steady basis. The United States, Mexico and Canada are producing in the aggregate about 3,000,000 pounds of newly mined copper daily. This is a large increase over the first two months of the year, and a broader demand is therefore an absolute necessity to take care of the present output. There is undoubtedly plenty of electrical expension mapped out which will furnish a greater demand, but no great progress along industrial lines can be expected until underwriting facilities are available." The Anaconda and St. Lawrence mines of the Amalgamated Company have been compelled to close on account of a new outbreak of the fire which has been under way in the mines for many years. The condition is not, however, different from what it has been at other times since the fire started, and the suspension will be only temporary. The Utah Copper Company is now turning out 5,000 tons of ore daily, and the management expects in the autumn to place the company on a basis where it will produce 5,000,000 pounds of refined copper per month. It is claimed that this metal will be produced at about 8 cents per lb. Many of the properties in the Butte district are in operation a portion of the time only, and the Amalgamated management is doing what it can to keep the production to somewhere near the demand. Exports for the week ended June 29 were 6490 tons, and for the month of June, up to and including June 29, were 25,439 tons. Closing quotations on the Metal Exchange June 29 were:

Lake	12⅝ @ 12¾
Electrolytic	12⅜ @ 12⅝
Castings	12¼ @ 12⅜

The London market was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	56 5 0	56 5 0
Standard copper, futures	57 0 0	57 0 0
Market	Weak.	Steady.
Sales of spot		400 tons
Sales of futures		1,500 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 5 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 5 0

KUZEL LAMP IN EUROPE.—Arrangements have just been completed by which the Pintsch Company has acquired the European rights to the Dr. Kuzel lamp. A factory will be started in London to manufacture these goods and it is expected that it will be in operation by August. W. J. Fahn, of Fahn & McJunkin, of New York, representatives of the Kuzel patents, will be general manager of the London factory. The business in this country will remain in the hands of Fahn & McJunkin.

ALLIS-CHALMERS COMPANY'S PRESIDENT OPTIMISTIC.—President Walter H. Whiteside, of the Allis-Chalmers Company, takes a sanguine view of the business situation. "There has been a marked improvement in the business of our company," he said, "within the last 90 days, and the bookings of machinery orders have increased from 30 to 90 per cent in that time. The business for June is at least 65 per cent of the normal, and is constantly increasing. New inquiries are coming forward in encouraging volume. They are of a much more substantial character than at any other time since the depression began. Their general tone denoted extensive plans in contemplation and for early development; the question of prompt shipment being already regarded an important consideration. The immediate requirements for a larger volume of new machinery for necessary extensions and improvements to existing plants are greater than for four years. This is for the reason that with many operating companies, purchases which under ordinary circumstances would have been made a year or 18 months ago, were put off, due to the monetary and other conditions, until to-day the factor of safety in these plants is becoming a serious matter, and new equipment must be added. Unlike previous depressions, following which collections for comparatively long periods continued very unsatisfactory, there was a substantial improvement within a short time after the recent flurry, and at the present time collections are exceptionally good."

NEW ENGLAND MILLS SUBSTITUTE ELECTRIC FOR STEAM POWER.—A 3000-hp electric plant will be installed shortly in the Pacific mills at Lawrence, Mass. The equipment will consist of three Allis-Chalmers-Parsons turbines of 1000 hp capacity each, and the building is so constructed as to permit an increase in the capacity to about 12,000 hp. New additions made to the mills required increased power, and it is planned to substitute eventually electricity for steam throughout. Considerable interest in copper circles is manifested in the success attending the operation of this plant, as in the equipment about $30,000 was expended for copper wire and cables alone, while the turbines each contain about 7500 pounds of copper. The Tremont & Suffolk Mills, in Lowell, have also taken steps to substitute electricity for steam power, and have recently installed an Allis-Chalmers-Parsons turbine of 3000 hp, the first of six units. The new American Thread mills, at Fall River, will be operated entirely by electricity.

UNITED WIRELESS TELEGRAPH COMPANY.—The United Wireless Telegraph Company has absorbed the International Wireless Telegraph Company and will hereafter control the patents and rights held by that company. The International company was mainly a manufacturing concern and was engaged in making apparatus under the Shoemaker patents. C. C. Wilson, president of the United company, says that a number of United States ships have installed his service and that a chain of wireless stations now extends along the Atlantic and Pacific Coasts. The connection between the two coast lines will be made as soon as the stations across the Isthmus of Panama are ready. President Wilson says that as soon as these connections are made messages can be sent from New York to Alaska by wireless. The International company was capitalized at $100,000. Mr. Wilson says that the shops of the United company are running full time manufacturing apparatus for new stations.

CUTLER-HAMMER SPECIALTIES.—It is announced that the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., is preparing to make and place on the market some new electrical specialties. A five-story building on Thirteenth Street and St. Paul Avenue, fronting the present Cutler-Hammer plant, has been purchased by the company and will be devoted to the new line of production. The novelties will consist of snap switches and lamp sockets, and it is understood that notable improvements have been effected in simplicity of design and in the reduction of the number of working or moving parts. The appearance of these goods on the market is awaited with intense interest by the trade and by the lighting industry in general. The established reputation of the Cutler-Hammer Company for its rheostats, etc., will, it is confidently expected, be enhanced by the new specialties.

WESTINGHOUSE AND BERGMANN COMBINE IN GERMANY.—The Westinghouse Electric interests in Germany have just completed arrangements with the Bergmann Electric Company, of Berlin, whereby the latter company will install the Westinghouse electric traction system in Germany. The Prussian State Railway Administration is preparing to electrify the steam railways, and already $12,500,000 has been appropriated to begin the work. This development involves enormous requirements. The details of the arrangement were not given out at the Westinghouse offices, although the fact that it had been completed was admitted. The Bergmann Electric Company is semi-American, Sigmund Bergmann, the head of the concern, having been a partner of Thomas A. Edison for a number of years. The company's plant in Berlin employs about 5000 men.

COTTON MILLS USING ELECTRICITY.—Within the last few years there has been a movement among the New England cotton mills toward the substitution of electricity for steam. At the present time 20 New England cotton mills are using steam turbines for the generation of motive power to operate their plants. These mills have already installed turbines having a capacity of 41,000 hp. Four years ago the New England cotton mills were operated entirely by steam or water power. Of these installations the General Electric Company has equipped eight mills with a total horse-power of 22,000; the Allis-Chalmers four mills with 10,600 hp, and the Westinghouse Electric & Manufacturing Company eight mills with 8000 hp. The total horse-power recently put into service is 40,600.

FRED. T. LEY & CO., INC., Springfield, Mass., have been awarded the contract for the second installation of lighting and power in the No. 3 Kerr Mill, Fall River, Mass. They have already completed the first installation, which consisted of wiring of the new power house, and the first and second floors of No. 3 Mill. They are now at work changing over the lighting system in the Nos. 1 and 2 Mills and installing a complete system for power, which, when completed, will change the mills throughout from steam driving to electrical operation.

ELECTRICAL EXPORTS TO GERMANY.—According to a bulletin just issued by the Bureau of Statistics of the Department of Commerce and Labor giving the exports to Germany for the first 11 months of the fiscal year ended June 30, 1908, the exports of electrical appliances were $187,629, as compared with $339,368 in the corresponding period of the previous year, and the exports of electrical machinery were $93,288, as compared with $89,146 in the corresponding period of 1907.

BERLIN ELECTRIC COMPANY.—The importing business of Mr. Felix Hamburger, which has been conducted at 78 Fifth Avenue, New York, has been purchased by the Berlin Electric Company, a newly organized corporation. The new company is controlled by Mr. Carl H. Reuter, of Philadelphia, and will handle in this country the German tungsten lamps and Siemens carbons. The headquarters of the new company will remain at 78 Fifth Avenue.

WESTERN UNION TELEGRAPH COMPANY.—Application has been made to the Railroad Commission of Mississippi by the Western Union Telegraph Company for permission to close about 150 offices of the company in that state. The company asserts that the business at these offices is so small at the present time that the offices are maintained at a loss.

PUBLIC SERVICE CORPORATION ORDERS ADDITIONAL MACHINERY.—In addition to the large order recorded in the Electrical World, of June 27, 1908, by the Public Service Corporation of New Jersey, from the General Electric Company, it has now contracted for a 9000 kw 60-cycle Curtis turbo-generator. This is for use at the Marion station.

OLD DOMINION COPPER COMPANY.—The Court of Errors at Trenton, N. J., has affirmed the decision of the Court of Chancery in refusing to appoint a receiver for the Old Dominion Copper Mining & Smelting Company. The suit was brought by John H. Pierce over a year ago.

CURTIS MARINE TURBINES.—One of the two 12,000-hp marine turbines for the Japanese battleship *Aki* was successfully tested this week at the Fore River shipbuilding yard. The speed is 450 r.p.m., and the turbines have an overload capacity of 13,500 hp.

NEW $10,000,000 JAPANESE HYDRO-ELECTRIC PLANT.—According to a consular report a $10,000,000 hydro-electric plant is to be established in Shiznoka prefecture.

NEW TUNGSTEN LAMP ON THE MARKET.—Mr. H. J. Jaeger, of the Jaeger Tungsten Lamp Company, of New York, announces that within a month that company will be in a position to introduce a new tungsten lamp on the market which Mr. Jaeger believes will have many features of special advantage. Mr. Jaeger has recently perfected a new exhaust pump, which

he believes will produce the best vacuum ever secured in the manufacture of these lamps. Mr. Jaeger has also recently developed a new process for purifying the tungsten metal which he thinks will make a very much better filament, will add largely to the life of the lamp and will prevent the blackening of the globe. A patent appliance, which is also new, Mr. Jaeger is confident, will support the filaments in the lamps in such a way that they will be much less liable to break from jar or from ordinary handling. The Jaeger Tungsten Lamp Company will increase its plant in the autumn and will enter more extensively into the manufacture of these goods. The Tipless Lamp Company will continue to act as sales agents and distributors of the output of the Jaeger Tungsten Company.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market was dull during the week ended June 29. There were some especially heavy losses, but the net change column shows fractional gains in many instances, and wherever there was a pronounced drop some plausible reason therefor can be found. Politics played little part in the market. The excessive heat was partly responsible for the unusual inactivity, but if buyers were eager or traders were anxious, the weather would not be a serious bar to business. Attention has been fixed upon crop news, the industrial situation and railroad reports. If large crops are harvested, which bring good prices there must of necessity be business for the railroads, and if farmers are prosperous a great revival of industrial activity will be seen. Crop news is good. The winter wheat is largely harvested, and the spring wheat crop is all that could be expected. The report of the American Railway Association indicated a decrease of 31,910 in the total of idle cars, and such

NEW YORK.

	June 22.	June 29.	Shares sold.		June 22.	June 29.	Shares sold.
All.-Ch.	11	11	500	Int.-Met., com.	10¾	10¾*	1,920
All.-Ch., pfd.	33	34⅝	2,600	Int.-Met., pfd.	27⅜	28⅜*	2,700
Amal. Cop.	66¼	66⅝	88,700	Mackay Cos.	65⅜*	65	200
Am. D. T.	39*	39	——	Mackay Cos., pfd	65¾*	64½	400
Am. Loc.	41¼	48	22,400	Met. St. Ry.	25*	25	100
Am. Loc., pfd.	101½	101½	1,105	N.Y.&N.J.Tel.	109*	105⅛*	282
Am. Tel & Cbl.	65*	67*	——	Steel, com.	36½	38	125,910
Am. T. & T.	117⅝	118⅝	2,700	Steel, pfd.	100⅞	101¼	9,625
B. R. T.	45¾	48	14,830	W. U. T.	53½	53	975
Gen. Elec.	130⅜	134*	800	West'h, com.	54½	55	25,770
Hud. R. Tel.	—	—	——	West'h, pfd.	70	80	800

PHILADELPHIA.

	June 22.	June 29.	Shares sold.		June 22.	June 29.	Shares sold.
Am. Rys.	44⅝	44¼	——	Phila. Elec.	9⅜	9½	——
Elec. Co. of Am.	11	10½	——	Phila. R. T.	13⅞	15⅝	——
Elec. Stor. B'ty.	32	30¾	——	Phila. Traction.	87	87½	——
E. S. B'ty, pfd.	49*	49*	——				

CHICAGO.

	June 22.	June 29.	Shares sold.		June 22.	June 29.	Shares sold.
Chicago City Ry.	190*	190*	——	Met. Elev., com.	17*	17*	——
Com. Edison.	96½	98	——	Met. Elev., pfd.	50*	50*	——
Chicago Subway.	19⅛	19	——	National Carbon.	69½*	70*	——
Chicago Tel. Co.	130	133¼	——	Nat. Carbon, pfd.	112*	112	——

BOSTON.

	June 22.	June 29.	Shares sold.		June 22.	June 29.	Shares sold.
Am. Tel & Tel.	117¾	118⅜	——	Mass. E. R., pfd.	47	46	——
Comb'ind Tel.	—	—	——	Mex. Tel., pfd.	—	—	——
Edison El. Ill.	208	207¾	——	New Eng. Tel'p.	111½	113	——
Gen. Elec.	131	134	——	W'st Tel. & Tel.	6*	6*	——
Mass. Elec. Ry.	10½	10	——	W. T. & T., pfd.	65¼	65	——

*Last price quoted.
Shares sold are for week June 20 to June 27.

important lines as the Illinois Central Railroad and the Pennsylvania Railroad reported that equipment which had been sidetracked for many months had been called into service. Reports, however, for April and May show continued decreases in gross and net earnings. The preliminary figures of the Treasury statement for the fiscal year can hardly be said to have had a distinct impression on Wall Street, although they show a marked decline in the receipts of the government. It is now estimated that the expenditures of the government exceed the revenues for the fiscal year ended June 30, 1908, by something like $60,000,000. Only twice since the Civil War has such a state of affairs existed, once in 1894 and again in 1899. Shipments of gold to Europe amounted to $50,000,000 during the present movement, but have really had no effect upon the local market for money. Both here and abroad rates have been extremely easy for weeks. Money, on June 29, ruled at 1¼ to 1½ per cent for call funds, while time loans were not in active demand at 2 to 2¼ per cent. The stock market, on the same date, was a trifle firmer, with total sales of 345,000 shares. Steel shares and Amalgamated Copper were notably stronger, and were leaders in activity. Brooklyn Rapid Transit displayed some activity and recorded a gain for the day of 1¼ points. The figures in the table are those of the close on June 29.

WESTINGHOUSE READJUSTMENT PLAN ASSURED OF SUCCESS.

While figures are not given out as to the exact amount which is lacking in the subscription to the new stock on the part of the stockholders of the Westinghouse Electric & Manufacturing Company, it is understood that all of the $4,000,000 which it was agreed that the merchandise creditors would take has been subscribed, and that of the $6,000,000 which the old stockholders were required to take there is now lacking something less than $1,000,000. Mr. A. H. Larkin, counsel for the Jarvie readjustment committee, will give out a statement setting forth the exact condition of the readjustment plan. This statement will show that it has been practically a success, and that a postponement of the final settlement of the plan until Sept. 3 has been made with the assurance that before that time all of the new stock will have been subscribed. This postponement was suggested to the readjustment committee by the stockholders' committee and the merchandise creditors' committee, and was accepted as a proper way of saving the company from going to foreclosure and sale. In the meantime officials in the Westinghouse company declare that business has been improving more actively than had been expected in the present general condition of trade. Orders are coming in, and while none of them is large individually, they are sufficient in the aggregate to warrant the continuous employment of workmen at the plants. The reports for May show a gratifying increase over the previous months. Judge James S. Young, of the United States District Court, at Pittsburg, has issued an order directing the receivers of the Westinghouse company to pay $500,000 interest due on the bonds and notes of the company July 1. Judge Young also directed that on Aug. 1 the receivers pay $180,000 interest on a $6,000,000 loan. The receivers said they had sufficient funds to meet these obligations. The reorganization of the Westinghouse company will result, it is said, in the creation of an exceptionally strong board of directors.

DIVIDENDS.

New York & New Jersey Telephone Company, quarterly, 1¾ per cent, payable July 15.

Radio Telephone Company, New York, quarterly, 1 per cent, extra 2 per cent, payable July 15.

Gamewell Fire Alarm Company, New York, quarterly 1¼ per cent, payable July 1.

Electric Storage Battery Company, New York, quarterly, ¾ of 1 per cent on common and preferred, payable July 1.

Mexican Telegraph Company, quarterly, 2½ per cent, payable July 16.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable July 9.

Bell Telephone Company of Pennsylvania, quarterly, 1½ per cent, payable July 15.

Massachusetts Lighting Companies, Boston, quarterly, 1½ per cent, payable July 15.

United States Smelting & Refining Company, quarterly, 1 per cent on common, 1¾ per cent on preferred, payable July 15.

United Metals Selling Company, quarterly, 5 per cent, payable July 15.

Commonwealth Edison Company, Chicago, quarterly, 1¼ per cent, payable Aug. 1.

RECEIVER FOR $22,000,000 COMPANY.—Randolph C. Barrett, of Barrett & Barrett, attorneys in Newark, N. J., has taken possession, as receiver, of the assets of the Consolidated Railway, Lighting & Refrigerating Company. The assets consist chiefly of the $16,309,000 stock of the Consolidated Railway, Electric Lighting & Equipment Company and $6,167,000 stock of the Railway & Stationary Refrigerating Company. The company was organized by Isaac L. Rice, who is its president. Arthur Lehman, P. J. Goodheart, August Fromuth and George W. Hoyt are on the board of directors. Among those who applied for the appointment of a receiver were G. Louis Boissevain, of New Castle, N. Y.; Charles S. Thorne, of New York, and stockholders living in Holland, who authorized Mr. Boissevain to begin proceedings in their behalf. The company was organized with a capital of $6,000,000 in 1901, but the authorized capital was increased to $22,000,000. The company was formed to hold the securities of its underlying companies. The petition alleges that the two subsidiary companies are largely in the experimental stage and have not been able to pay a dividend.

BUTTE (MONT.) ELECTRIC & POWER COMPANY.—It is announced that directors of the Butte Electric & Power Company, at the July meeting will resume the payment of dividends. Payment was suspended six months ago. The old rate of 1¼ per cent quarterly will probably be declared. An official of the company says that the declaration of the former rate is warranted. He states that earnings are now running considerably in excess of those of a year ago; in fact, they have been doing so for the past three or four months despite the shutdown of the Butte mines. The dividend would never have been passed had it not been for the fact that the company borrowed considerable money to make extensions and improvements and acquire new plants, hoping to reimburse its treasury by the sale of bonds, and then found that the bond market was too poor to enable it to dispose of the securities at favorable terms. So the stockholders authorized the issue of $5,000,000 joint mortgage bonds bearing 6 per cent interest, and the company executed the mortgage and put the bonds in its treasury awaiting the time when the market would take them on a better basis. Then the dividend was passed and most of the surplus earnings were applied to liquidating the debt. Now the time is propitious for the sale of about $1,000,000 of these bonds and they will be offered to stockholders. It is reported that they will be put out at about 93½. The bonds are a mortgage upon properties of the Butte Electric & Power Company, the Madison River Power Company and the Billings & Eastern Montana Power Company.

MEXICAN TELEGRAPH COMPANY.—In a statement issued to the stockholders of the Mexican Telegraph Company, Mr. James A. Scrymser, president of the company, declares that the company is prospering and that the stock is increasing in value. He says that only 235 shares of the stock changed hands in 1907, and that these were sold at prices ranging from $235 to $250 per share. Of the Central & South American Telephone Company, which is controlled by the Mexican company, there were transferred 5945 shares at prices ranging from $105 to $110 per share. At the end of 1907 the surplus of the Mexican Telegraph company was $2,381,894. There have been issued to shareholders, as dividends, full-paid shares, amounting to $1,734,500. The net surplus of the Central & South American Company on Dec. 31 last was $1,019,819. There have been issued to shareholders as dividends full-paid shares amounting to $2,732,800. As to the future of both companies, it is asserted that the commerce of Mexico, Central and South America is rapidly developing and that the growth of traffic of both companies has always provided full dividends for increased capitalization and added largely to the surplus. Both companies are said to be free from any fixed charges, and, although operating in 17 countries, neither has a lawsuit.

AMERICAN SMELTING & REFINING COMPANY REDUCTIONS.—The reductions in salaries and expenses of the American Smelting & Refining Company have been extensive. Salaries have been cut all along the line. Speaking of the economies Mr. Daniel Guggenheim said: "Before I left for Europe I set the ball rolling by reducing my own salary. My brothers, who devote their entire time to the affairs of the company, also reduced their salaries voluntarily. While our salary list is reduced by $750,000, I am informed that the efficiency of our labor has improved from 60 to 80 per cent to nearly perfect. That means another great saving in expenses." S. W. Mudd, one of the engineers of the company, is now otherwise employed and is devoting his attention to the Ray property of the Kelvin district of Arizona, which is controlled by the Utah copper interests. A. Chester Beatty has not left the employ of the Guggenheims, as reported, but will probably be manager-in-chief of the Guggenheim Exploration Company.

AMERICAN LOCOMOTIVE COMPANY.—The American Locomotive Company has declared the customary quarterly dividends of 1¼ per cent on the common stock and 1¾ per cent on the preferred stock. This announcement was a surprise to financial circles, as it had been freely predicted that disbursements would be curtailed owing to the decline in earnings. The statement was given out by the management of the company that while few railroads have ordered as much rolling stock as in 1907, the earnings of the company for the year ending June 30 will be large enough to warrant the payment of the regular dividends. The large earnings of the company within the last few years have placed it upon a substantial financial basis. Only a few of the plants are in operation now and some of those are on part time, so that the operating expenses have been reduced.

NEW HAVEN ROAD MUST SELL TRACTION STOCKS.—Judge Rugg, of the Supreme Court of Massachusetts, has rendered a decision which finally prohibits the New York, New Haven & Hartford Railroad, its officers, directors, agents and employees from holding any stock in the various traction companies named in the information filed recently against the New Haven company by Attorney-General Dana Malone. The decree gives the company until July 1, 1909, to dispose of its present holdings in these companies. Before announcing the decree the court denied the motion of the New Haven company for leave to show that it had parted with all its traction holdings except in the Worcester & Webster and the Webster & Dudley street railway companies.

KANSAS CITY RAILWAY & LIGHT COMPANY.—Spencer Trask & Company, New York, have purchased from the Kansas City Railway & Light Company $800,000 of first lien refunding 5 per cent bonds, due in 1913. These bonds are a portion of an authorized issue of $20,000,000, of which $9,220,000 bonds are now outstanding. The remainder of the bonds are held for retiring underlying bonds. The bonds are a first lien upon the entire lighting plant, including the central power station, and also upon certain portions of the street railway lines. The gross earnings of the company for the year ending May 31, 1908, were $6,144,548, the net earnings were $2,917,853, and the surplus, after paying taxes, interest on bonds and floating debt, was $1,079,838.

COLUMBUS (OHIO) EDISON LIGHT & POWER COMPANY.—The Columbus Edison Light & Power Company has issued a letter to stockholders offering new issues of common and preferred stock at par. This stock was authorized some time ago, but was not offered for sale for the reason that negotiations were under way with the General Electric Company regarding a royalty on the equipment in the plant. The royalty was based on the capitalization of the company. The General Electric Company released the company from the payment of royalty. The Columbus Railway & Light Company will purchase the stock that is not taken by present stockholders.

SEATTLE (WASH.) ELECTRIC COMPANY.—The increase in traction and lighting business in Seattle, Wash., has been large. In 1898 a syndicate was formed to acquire the street railway, electric lighting and power plants. At that time nine traction companies and four lighting and power companies existed. When the Seattle Electric Company was formed it absorbed six of the traction and three of the electric-light concerns. The gross earnings of the companies 10 years ago were $680,000. Gross earnings now are at the rate of over $4,300,000, and 155 miles of track are operated and 14,000 light and power customers served.

CHICAGO CONSOLIDATED TRACTION COMPANY RECEIVERS.—David R. Forgan and John M. Roach have been appointed receivers of the Chicago Consolidated Traction Company by Judge Grosscup, of the United States Circuit Court, Chicago. The receivers executed bonds for $25,000 and took charge of the business of the company. The receivers were appointed on a petition filed by the Central Trust Company, of New York, which was acting as trustee of the Equitable Trust Company, of Chicago, the latter being trustee under mortgages covering the properties of the traction company.

TOLEDO RAILWAYS & LIGHT COMPANY.—A receivership for the Toledo Railways & Light Company has been avoided by an agreement with the Bondholders' Protective Committee. It has been announced through this committee that holders of the first consolidated mortgage 4 per cent bonds would not insist upon the payment of the interest due on July 1 on those bonds, and that the company will pay the coupons on the underlying bonds. Several of the company's franchises expire next year, and some of the underlying bond issues are due then.

ELECTRIC STORAGE BATTERY CUTS DIVIDEND.—Directors of the Electric Storage Battery Company have declared quarterly dividends of ¾ of 1 per cent on both the common and the preferred stock. These dividends are at a reduced rate and compare with 1 per cent on each of the issues for the previous quarter and 1¼ per cent for the last quarter of 1907. The business situation is given as the cause for the reduction.

PUBLIC SERVICE CORPORATION DIVIDEND.—A quarterly dividend of 1 per cent, payable on June 30 to stockholders of record on June 29, has been declared by the Public Service Corporation of New Jersey. The company has $12,500,000 stock outstanding.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

EUFAULA, ALA.—A franchise has been granted the Alabama Railway & Electric Company to build an electric railway in Eufaula. J. C. Chapman is vice-president.

HEADLAND, ALA.—The municipal electric light plant was put into operation June 20 and is now furnishing electricity for lighting the streets and residences of the town.

BERKELEY, CAL.—The San Francisco, Oakland & San Jose Railway Company has applied to the Town Trustees for a franchise to extend its railway from Alcatraz Avenue through Sacramento Street to Hopkins Street, the northern boundary of the town.

GLENDORA, CAL.—The Glendora Light & Power Company contemplates the construction of at least two miles of suburban lines this fall.

GONZALES, CAL.—The Gonzales Electric Company has purchased the franchise offered for sale by the Board of Supervisors, to furnish electricity in Gonzales.

GRIDLEY, CAL.—The City Trustees have passed an ordinance calling for an election July 13 to vote on the proposition to issue $33,000 in bonds, the proceeds to be used for a municipal electric light plant and water works system.

KING CITY, CAL.—The franchise for furnishing electricity and water in King City was sold by the Board of Supervisors to Lierl & Baird.

MERCED, CAL.—The Board of Supervisors has granted the Yosemite Dredging & Mining Company permission to erect poles along the Upper Snelling and La Grange public highway.

MODESTO, CAL.—The Board of Supervisors has granted the application of the La Grange Water & Power Company to erect a transmission line for the distribution of electricity for lamps and motors.

RED BLUFF, CAL.—Harry Polsley and George J. Hiller have filed on 1000 cu. in. of water in the South Fork of Cottonwood Creek, which it is proposed to use for irrigation purposes and to generate electricity.

RED BLUFF, CAL.—Some time ago valuable water rights were secured on Mill Creek and are now controlled by Gorham King, W. A. Fish, T. H. Ramsey, S. P. Stice, E. D. Garner estate, Smith Crowler and W. F. Luning. These men are now negotiating with a party of capitalists who will, if they secure the rights, expend $1,000,000 in the construction of an electric power plant. Surveyor Luning, D. A. Fish and John Gurnsey have been on Mill Creek recently making detailed surveys.

SAN FRANCISCO, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 7, for furnishing at the Navy Yard, Mare Island, Cal., an electric motor pillar crane, capacity five tons. Application for proposals should refer to schedule 1. E. B. Rogers, paymaster general, U. S. N.

YREKA, CAL.—G. A. Tebbe and Fred Hetschel have appropriated 3000 cu. in. of water of the east fork of Horse Creek to be utilized for mining, power and lighting purposes.

ARVADA, COL.—Articles of incorporation have been filed for the Arvada Electric Company by George P. Sanger, J. M. Blincoe and C. W. Lothrop. The company has been granted a franchise to furnish electricity in Arvada, and will erect a transformer station at a cost of $32,000. Electricity for operating the system will be furnished by the Denver Gas & Electric Company, of Denver. Later the company will furnish electrical energy in other parts of Jefferson County.

CANON CITY, COL.—Arrangements are being made by the Colorado Telephone Company for the construction of a telephone line into the Royal Gorge, a distance of eight miles.

DENVER, COL.—The Denver & South Platte Railway Company has awarded the contract for the construction of an extension of its road from Denver to Roxbury Park and Colorado Springs, a distance of 25 miles, to William J. Coursin, of Pittsburg. T. I. Milner is chief engineer.

HARTFORD, CONN.—The New York, New Haven & Hartford Railroad Company has applied to the State Railroad Commissioners for an approval of the layout and proposed method of building an electric railway from Willimantic to South Coventry.

WASHINGTON, D. C.—Permission has been granted to the Baltimore & Washington Transit Company to build a railway into the District of Columbia. The company is also planning to construct an extension to Sandy Spring, a distance of 14 miles. William A. Mellen, of Washington, is manager.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent U. S. capitol buildings and grounds until July 15 for electric lighting fixtures for the office building of the U. S. Senate. Each bidder will be required to deposit $25 with the above office to guarantee the return of the drawings after the award of the contract. Elliott Woods is superintendent U. S. capitol buildings and grounds.

WEST PALM BEACH, FLA.—The Ariston Ice & Electric Company has been granted a franchise to furnish electricity for lighting in the city.

EAST POINT, GA.—The city is considering the question of issuing $15,000 in bonds for the construction of an electric light plant.

WAYCROSS, GA.—The State Railroad Commission has notified the Waycross Electric Light & Power Company that unless a good reason can be shown why it should not do so the Commission will on June 24 issue an order requiring the company to install meters where desired, and fixing the rate to be charged for electricity for all purposes, and also requiring the discontinuance of the rule requiring a deposit by the customers.

MACKAY, IDAHO.—The Lost River Light & Power Company contemplates the construction of an electric light plant in Mackay. It is proposed to utilize the water power of Cedar Creek to furnish power to operate the plant. A pipe line 700 ft. in length will be built to the power house. The plant will furnish electricity for lighting the town and operating the Mackay lines. R. L. Rockwell, of Ontario, Ore., is interested in the project.

BARTONVILLE, ILL.—The Interstate Telephone Company has been granted a franchise by the Village Board to erect a telephone system in Bartonville.

CHICAGO, ILL.—The Commonwealth Edison Company, it is said, will make a voluntary reduction in the price of electricity for lamps and motors on Aug. 1.

CHICAGO, ILL.—The Corn Products Manufacturing Company has commenced work on the construction of a plant at Argo, Ill., on the Drainage Canal. The first unit will be operated by electricity generated by the company's plant at Argo. The plans and specifications for the electrical installations have been completed and orders have been placed with the Allis-Chalmers Company, of Milwaukee, Wis., for generating machinery aggregating 1500 kw. The motors and other electrical equipment necessary for the operation of the plant have not been purchased. No definite information of the plans for construction has been given out. The main office of the company is located at 42 East Madison Street, Chicago.

EAST ST. LOUIS, ILL.—A new electric light plant is to be established in East St. Louis to be known as the Consumers' Electric Light & Power Company. The directors are J. Sweeney, Alexander Flannigan and William Hauss, of East St. Louis.

KEWANEE, ILL.—Bids will be received by W. Wiesner until July 8 for the construction of a municipal electric light plant which will include power house, pole line and wiring, two dynamos, gas-producer engines and various accessories. Bids on a steam plant will also be received. Plans for the above plant can be seen at the office of the city clerk and at the office of Oscar Clausen, St. Paul, Minn.

PONTIAC, ILL.—At a recent meeting of the Commercial Club the necessary bonds, it is said, were raised by the citizens of Pontiac for the extension of the Bloomington, Pontiac & Joliet Electric Railway from Dwight to Pontiac. It is reported that work on the extension will commence at once. H. A. Fisher, of Joliet, is president of the company.

FORT WAYNE, IND.—The McBride Electrical Company, which is constructing the transmission lines in connection with the municipal electric light plant, has notified the Board of Public Works that the line work will be completed by July 1. It is expected to have the plant in operation by Aug. 1.

GOSHEN, IND.—A movement is on foot to call a special election for purpose of getting the opinion of the citizens regarding the sale or improvement of the municipal light plant. The city councilmen say that the plant is out of date and overloaded. The improvement contemplated will cost $60,000.

LOGANSPORT, IND.—The City Council contemplates rebuilding the municipal electric light plant at a cost of $30,000.

MARION, IND.—Otis Wessner, superintendent of the municipal electric light plant, has recommended the purchase of additional boilers and engines for the city plant.

MONTICELLO, IND.—The Monticello Telephone Company contemplates placing its wires underground in the business section of the city upon the completion of its new telephone exchange building.

STINESVILLE, IND.—The United States Steel Corporation has purchased over 300 acres of stone land near this place on which it will build and equip stone crushing mills, machine shops and an electric light and power plant. It is estimated that $1,500,000 will be expended on the plants.

TERRE HAUTE, IND.—The controlling interest in the Paris Traction Company has been purchased by an eastern syndicate, which, it is said, will extend the railway to Ridgefarm, Ill., at once.

ALBIA, IA.—The Albia Interurban Railway Company has awarded contracts for the construction of the extension of its railway system to Hiteman, a distance of six miles, work on which is expected to begin in the fall. W. E. Gant is general manager.

ATCHISON, KAN.—Contracts for remodeling the Atchison electric light plant will be awarded in the near future. The cost of the work is estimated at about $30,000.

CHERRYVILE, KAN.—A franchise has been granted to the Union Street Railway Company, of Winfield, Kan., to extend its railway into Cherryvale. L. H. Sigins, of Coffeyville, is president.

COLBY, KAN.—Otis L. Benton and A. S. Steele, of Oberlin, have acquired the controlling interest in the local telephone system. Plans are being considered for enlarging and improving the plant.

DODGE CITY, KAN.—Plans are contemplated for building a transmission line along the Arkansas River Valley in Western Kansas and Eastern Colorado from Canon City, Colo., to Dodge City. Electricity will be furnished for irrigation purposes. The construction of an electric railway in connection with the above system may be considered at a later date. Frank G. Austin, of Garden City, Kan., is said to be interested in the project.

FT. SCOTT, KAN.—Plans are being considered by the Missouri & Kansas Telephone Company for extensive improvements in and around Ft. Scott, which will involve an expenditure of about $75,000.

LINWOOD, KAN.—The city has authorized the issue of $40,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant and water works system.

PIKEVILLE, KY.—The Eastern Kentucky Home Telephone Company contemplates the erection of a telephone line from Hellier to Elkhorn City in the near future.

PINEVILLE, KY.—The City will on July 6 sell a franchise to erect and operate a telephone system in Pineville. David Hahn is mayor.

RICHMOND, KY.—Plans are being considered for the construction of an electric lighting and heating plant for the Kentucky Eastern Normal School, the cost of which is estimated at $25,000. Anderson & Frankel, State University, Lexington, are the engineers.

WHITESBURG, KY.—Plans are being prepared by the Whitesburg Telephone Company for the construction of a telephone line from Whitesburg via Stonega to Big Stone Gap, Va.

BEVERLY, MASS.—A petition has been filed with the State Board of Gas and Electric Light Commissioners by Councilman Henry E. Woodberry, of Beverly, asking that the prices charged by the Beverly Gas & Electric Company be reduced as follows: For gas $1.10 per 1000 cu. ft., and the price of electricity to 10 cents per kw-hour.

BROCKTON, MASS.—The Old Colony Street Railway Company has been granted permission to place its wires in underground conduits on certain streets in the city.

WEBSTER, MASS.—Arrangements are being made by the Webster & Stourbridge Gas & Electric Company for extension of its high-tension transmission line from Webster to Southbridge. The company also contemplates extending a transmission line to Stourbridge.

BARAGA, MICH.—The Baraga County Telephone Company contemplates extending its system to give connections with L'Anse, Skanee, Keweenaw Bay, Assinins and several other places.

DETROIT, MICH.—The Detroit, Flint & Saginaw Electric Railway Company, which has been in the hands of a receiver, was sold recently at auction to Isaac Applebaum, owner of $250,000 of the company's bonds, for $50,000.

MARQUETTE, MICH.—The contract for the construction of the substation in connection with the municipal electric light plant has been awarded to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., for $8,000. R. Retallio is superintendent.

TRAVERSE CITY, MICH.—Bids will be received by the Boardman River Electric Light & Power Company until July 15 for raising its "Upper Dam" from its present head of 22 ft. to 41 ft. Plans may be seen at the office of the ELECTRICAL WORLD, Old Colony Building, Chicago, Ill., office of William G. Fargo, Jackson, Mich., and at Traverse City.

PELICAN RAPIDS, MINN.—The Pelican Rapids Telephone Company contemplates extending its system from Pelican Rapids to Oak Lodge.

REDWOOOD FALLS, MINN.—The Redwood Falls Milling Company is contemplating enlarging its electric light and power plant. A. C. Burmeister is president.

ST. CLOUD, MINN.—A. G. Whitney, president of the Public Service Company, has purchased the dam and property of the St. Cloud Water Power Company.

CARROLLTON, MISS.—The contract for the machinery for the municipal electric light plant has been awarded to the Delta Machine Company, Greenwood, Miss., for $4,250. R. C. Houston is engineer.

NATCHEZ, MISS.—The property of the Southern Light & Traction Company was sold June 16 at a trustee's sale to Lynn H. Dinkins, president of the company and president of the Interstate Trust & Banking Company, of New Orleans, La., for $5,000 more than the liabilities of the company. A new company has been incorporated under the name of the Southern Railway & Light Company to take over the property. The capital stock of the new company is placed at $456,700.

IRONDALE, MO.—Preliminary arrangements have been made for the construction of an electric railway from Belgrade to Perryville, Mo. It is proposed to erect a dam across the Big River near Irondale, which will furnish power to generate electricity to operate the railway system. St. Louis capitalists are said to be interested in the project.

KANSAS CITY, MO.—Arrangements are being made by W. F. Lyons, of Kansas City, to erect an ice plant, including one 100-kw and one 300-kw generator. C. E. Sample is engineer.

KANSAS CITY, MO.—Work has commenced on the construction of the proposed electric railway of the Blue Valley Railway Company, which is to connect Kansas City, Leeds and Swope Park. The road will be 10 miles in length, and electricity for operating the system will be supplied by the Metropolitan Street Railway Company. The company is capitalized at $100,000, and the officers are: Alexander Massey, president; J. S. Chick, Jr., secretary and treasurer; F. W. Wallenhaupt, electrical engineer.

SPRINGFIELD, MO.—The Springfield, Nixa & Southern Electric Railway Company is reported to have commenced surveys for its proposed railway between Springfield and the James River. The road will be 14 miles in length and will cost about $350,000. It is proposed to erect a power plant at Nixa, which will be operated by water power.

BILLINGS, MONT.—The Eastern Montana Power Company is planning to construct a transmission line throughout eastern Montana within a short time.

GREAT FALLS, MONT.—The property of the Great Falls Water Power & Town Site Company, owned by James J. Hill and associates, has been purchased by John D. Ryan and others for $1,500,000. The property includes a large water power plant at Black Eagle Dam and the entire water rights of the Missouri River from Great Falls, east to the "Big" Falls, a distance of 12 miles. It is probable that a large electric power plant will be erected at the latter place.

REDSTONE, MONT.—Plans are being considered by the Montana Star Telephone Company to erect a telephone line to Glasgow, via Culbertson.

GENOA, NEB.—John W. Early, of Columbus, Neb., has been engaged by the Village Council to prepare plans for the proposed municipal electric light system. The cost of the plant is estimated at $11,000.

FLORENCE, NEV.—Announcement has been made by John B. Morris, of Erie, Pa., and Robert E. Archibald, of Cleveland, Ohio, representing a syndicate of Brooklyn and Philadelphia capitalists, that an electric power plant and custom mill will be erected in Florence.

RENO, NEV.—Col. W. C. Rose, of Tonopah, has filed a notice of appropriation of water rights in Humboldt County. It is proposed to develop the water power to generate electricity to be used in the Seven Troughs mining district camps.

RENO, NEV.—It is reported that the Nevada Gas & Electric Company, controlled by Chicago and Pittsburg capitalists, will soon commence work on the construction of power plants on the Carson and Truckee Rivers for the purpose of supplying electricity in Carson, Reno and Virginia City for lamps and motors, and also to the mines of Virginia City. It is also said that the company contemplates building an electric railway from Reno to Lake Tahoe.

LANCASTER, N. H.—The Jones & Linscott Electric Company has been incorporated, with a capital stock of $40,000, and will take over the electric plant owned by Jones & Linscott. H. H. Jones is president and F. S. Linscott treasurer.

MILFORD, N. H.—Extensive improvements are being made to the plant of the Milford Electric Light Company, which include a new chimney and installation of new machinery.

DOVER, N. J.—The Council has awarded a ten-year contract to the Dover Electric Light Company for lighting the streets of the town. The rate for street lamps under the new contract is a slight increase over the old contract, which expires July 1. Under the terms of the new contract the price for arc lamps is $85 each per year and $17 each per year for incandescent lamps, making an increase of $1 per year per lamp. The company also furnishes electricity for lighting the police station, fire engine house and other municipal buildings, free of cost, which heretofore has been charging meter rates for this service.

BINGHAMTON, N. Y.—The Board of Contract and Supply has awarded the contract for lighting the streets of the city and the public buildings to the Binghamton Light, Heat & Power Company. The contract is for a term of three years, under which the company is to furnish 420 or more arc lamps and 480 or more incandescent street lamps as follows: each enclosed arc lamp at $80 per lamp for the first year; $75 per lamp the second year, and $70 per lamp for the third year, and $20 each per year for the incandescent lamps. The company also agrees to furnish electricity for lighting the city hall and other public buildings, including free renewals of standard 4, 8, 16 and 32-cp incandescent lamps, at the rate of six cents per kw-hour. Under the new contract the city will save $13,260.

DUNKIRK, N. Y.—Plans are being contemplated to extend the street lighting system, and Assistant Secretary Baumgartner has been authorized to secure bids on equipment for 75 arc lamps. A new turbo-generator set has recently been installed in the municipal electric light plant.

EAST WILLIAMSON, N. Y.—The Sodus Gas & Electric Light Company is extending its transmission lines from Sodus to this village and will furnish electricity for lighting the streets and residences in Williamson in the near future.

FAIRPORT, N. Y.—The proposition to issue bonds for improvements to the municipal electric light plant was defeated at an election held June 5.

FLUSHING, N. Y.—The New York & North Shore Traction Company contemplates the construction of an electric railway from the city line at Little Neck to Flushing, for which the right of way is now being secured. Thomas Wood, of Roslyn, is general manager.

HAMBURG, N. Y.—Owing to the failure of the electric light company

to comply with the terms of the contract the Village Board has decided to serve a notice upon H. D. Pierce canceling the contract for lighting the streets of the village.

LONG ISLAND CITY, N. Y.—The New York & Queens County Railway Company has been granted a franchise for the construction of two branches to its present railway system, one from Flushing to Whitestone; the other from Flushing to Bay Side.

NEW YORK, N. Y.—The contract for furnishing the electric equipment for the University Heights Bridge was awarded to the Spiro Company, of New York City, for $6,690, by J. W. Stevenson, commissioner Department of Bridges.

NEW YORK, N. Y.—A complete power plant has recently been purchased by Tiffany & Company, of New York, of Dravo, Doyle & Company, of Pittsburg, Pa., which includes two De Laval steam turbine generator sets, Heine water-tube boilers, Cochrane feed-water heaters, etc.

NEW YORK, N. Y.—Bids will be received until July 6 by C. B. J. Snyder, superintendent of school buildings, for alterations and additions to electric equipment in Public School No. 81, Borough of Manhattan; also for alterations and additions to electric equipment in the Jamaica Training School, and Public Schools Nos. 7, 14, 20, 27, 31, 37, 47, 72, Borough of Queens.

ONEIDA, N. Y.—The Madison County Gas & Electric Company has applied to the Public Service Commission at Albany for authority to issue $45,000 in bonds, the proceeds to be used to rebuild the plant at Oneida.

PATCHOGUE, L. I., N. Y.—The Village Trustees have entered into a contract with the Patchogue Electric Light Company for lighting the streets of the village for a term of five years. The company is to furnish 125 or more of 25-cp incandescent lamps at $18 per lamp per year with all-night service. The company also agrees to furnish two additional lamps at the intersection of Main Street and Ocean Avenue, to furnish electricity for lighting the village office and to place a lamp in front of the Vanguard Hose House and other fire houses that may be established in the village without cost to the municipality.

PORT JERVIS, N. Y.—Plans have been approved by the Public Service Commission for the reconstruction of the Port Jervis Electric Railway, which will involve an expenditure of $94,053.

SARATOGA SPRINGS, N. Y.—Bids will be received by the Sewer, Water and Street Commission until Aug. 7 for lighting the streets and public buildings of the village with gas or other illuminant for a term of four years beginning Oct. 4, 1908. At present there are 152 arc lamps, 155 incandescent electric lamps and 218 gas lamps in use. David S. Wakeley is clerk.

SYRACUSE, N. Y.—The City Council has awarded the contract for city lighting for a term of five years to the Syracuse Lighting Company. Under the terms of the contract the company is to furnish arc lamps at the rate of $68 per lamp per year, which provides for a minimum of 1400 lamps, and all in excess at the same price. Electricity for lighting the city hall and other public buildings and for motors will be furnished at the rate of 6 cents per kw-hour.

UTICA, N. Y.—Plans are being made by the Utica & Mohawk Valley Railway Company to commence work on the Mohawk Street Railway extension in the near future.

HICKORY, N. C.—The Hickory Railway & Power Company is to change its name to the Hickory Railway Company. M. E. Thornton is the principal owner.

DAYTON, OHIO.—The capital stock of the People's Railway Company has been increased from $1,100,000 to $2,500,000, the proceeds to be used for completing improvements to the system. The company is now building a new power house, and has purchased a site in Edgemont, on which new car barns will be erected.

LAFFERTY, OHIO.—The Pittsburg & Belmont Coal Company has recently placed a contract with Dravo, Doyle & Company, of Pittsburg, Pa., for two automatic Erie Ball engines to be direct connected to a 200-kw generator and a 150-kw generator.

MENDON, OHIO.—The Mercer County Mutual Telephone Company is planning extensions to its system this summer, which will include the erection of about 60 miles of new toll lines.

OXFORD, OHIO.—The Oxford Telephone Company is making plans to install a new switchboard and erect a number of new rural telephone lines.

FAIRVIEW, OKLA.—Messrs. Burns & McDonnell, of Kansas City, Mo., have been engaged to take charge of the construction of the proposed municipal electric light plant and water works system. The cost of the work is estimated at $65,000.

MYRTLE POINT, ORE.—The Coquille Valley Power Company is planning to construct an electric railway from Coos Bay to Roseburg, via Myrtle Point up the north and east forks of the Coquille River. The officers of the company are: E. F. Davenport, president; C. C. Carter, vice-president; W. F. Hendries, secretary, and J. R. Benson, treasurer.

PORTLAND, ORE.—The Wasco County Electric Water Power Company has awarded the contract for the construction of its proposed electric railway in the Deschutes and John Day Valleys to the Portland Construction Company. The railway will extend from Condon to Bend, with branches to Howard and Dayville, work on which, it is said, will begin in the near future. The company also proposes to build power plants on the Deschutes and John Day Rivers. G. S. Carpenter, of Fossil, Ore., is president.

PORTLAND, ORE.—The Cazadero power plant of the Portland Railway, Light & Power Company was wrecked on June 22, causing a loss of about $110,000. The damage was due to the "running away" of the water wheels and the wrecking of the generators. Work will be started at once to replace the generators destroyed. In replacing the machinery three 2500-kw, 60-cycle, 24-pole generators will be installed in place of the 33-cycle apparatus, which will do away with the frequency changers installed in the substations for converting the 33-cycle current to 60-cycle, the latter being used for lighting. As soon as the three units are replaced, steps will be taken to install two additional units of the same rating, which will give the entire plant an output of 25,000 hp. B. S. Josslyn is president.

WOODBURN, ORE.—A petition has been filed with the county court by the Northwestern Long Distance Telephone Company for a francnise to erect a telephone line between Woodburn and Silverton.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until July 13, for the following supplies: Dry batteries, wire rope, condenser tubes, dynamos, oils, etc. Blanks and general information pertaining to this circular (No. 451) may be obtained at the above office or the offices of the assisting agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La.; 1086 North Point Street, San Francisco, Cal.; also from the U. S. engineer offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky., and Mobile, Ala. Lieut. H. F. Hodges is general purchasing officer.

CANTON, PA.—The Sullivan County Telephone Company, which has recently completed a new telephone line from Shunk to Canton, is planning other extensions of its system in Sullivan County.

CHAMBERSBURG, PA.—It is reported that the Franklin County Commissioners have decided to install an electric light plant at the County Infirmary.

DARBY, PA.—Bids will be received until July 6 for lighting the streets of the city for a period of one to five years. Robert B. Montgomery is chairman of the light committee.

INDIANA, PA.—At a recent meeting of the stockholders of the Indiana Street Railways Company steps were taken to extend its street railway system from Homer City to Blairsville, for which the contract for construction will be let in a short time.

PALMERTON, PA.—The Palmerton Telephone Association has acquired the telephone franchise between Bowmanstown and Kunkletown, formerly owned by the Chestnut Ridge Railroad Company. It is said that the old line will be rebuilt and an exchange installed.

POTTSTOWN, PA.—Bids will be received by the property committee for lighting the streets of the borough by electricity or gas for a term of three and five years. C. H. Briedenbach is chairman of the committee.

PROVIDENCE, R. I.—Plans are being made by the Narragansett Electric Lighting Company for increasing the output of its plant before the coming winter. It is proposed to install a new 3000-kw steam turbine. The present output of the plant is about 15,000 kw.

GUFFNEY, S. C.—J. Q. Little and others interested in the construction of the Cherokee Oil Mill have decided to utilize electricity from the Gaston Shoals plant.

SIOUX FALLS, S. D.—The Brookings & Sioux Falls Electric Railway Company contemplates the construction of an electric railway from Brookings to Flandreau, a distance of 10 miles. Neill Stewart, of Brookings, is manager.

MEMPHIS, TENN.—It is reported that contracts will be let by the Lake View Traction Company for the construction of its electric railway in the near future. The company plans to build an electric railway from Memphis to Lakeview, Tenn., and Clarksdale, Miss., a distance of 77 miles; also from Memphis to Collierville, 28 miles; Memphis to Covington, 33 miles, and 15 miles within the city limits of Memphis. R. F. Tate is president.

BROWNSVILLE, TEX.—The Ohio & Texas Sugar Company is planning to install two automatic Erie Ball engines, each direct connected to 100-kw generators, to furnish electricity for lamps and motors for its plant.

DALLAS, TEX.—At an election held recently the citizens voted against the proposition to establish an electric light plant.

DALLAS, TEX.—The Southern Telephone Company contemplates rebuilding its telephone lines between Dallas and West Dallas. J. E. Farnsworth is general manager.

BUCHANAN, VA.—James P. Wood, of Roanoke, Va., is reported to have purchased a water power on James River at Little Tunnel, about nine miles from Buchanan, where it is estimated that 3000 hp can be developed. It is proposed to construct a dam and tunnel.

NOTTOWAY, VA.—It is reported that the Kennedy-Walker Land & Development Company, of Kenbridge, Va., is contemplating the construction of an electric light plant on Crystal Lake near Nottoway. It is proposed to carry the water from Little Nottoway River into Crystal Lake by means of a flume. C. H. Moorefield and W. N. Preas, of Virginia Polytechnic Institute, Blackstone, Va., are the engineers.

PULASKI, VA.—We are informed that Edgar C. Wiley, of Lynchburg, will prepare plans for the hydro-electric power plant, the cost of which is estimated at $50,000. An election will be held July 10 to vote on the proposition to issue $75,000 in bonds for construction of the plant. John T. Loving is mayor.

RICHMOND, VA.—The Common Council on June 22 passed the ordinance providing for an issue of $350,000 for a municipal electric light over the veto of Mayor McCarthy.

BRIDGEPORT, WASH.—James Fullerton, of Seattle, representing the Buffalo Power Company, has applied to the County Commissioners for a franchise to construct and operate an electric railway from Coulee City up Grand Coulee to a point opposite the San Poil, for which it is said rights of way have been secured. It is planned to build branches from steamboat Rock to Bridgeport and from Coulee City to Waterville. The company will also furnish electricity for lamps and motors along its street car lines.

CASHMERE, WASH.—The Valley Power Company, which is constructing a power plant in the Wenatchee Valley, expects to have its plant in operation in August, when it will furnish electricity for lighting the town. Plans are being prepared for the construction of a water works system for Cashmere. The pumping station will be operated by electricity, which will be furnished by the Valley Power Company. C. C. Ward is preparing plans for the water works system.

ELLENSBURG, WASH.—The City Council is considering the question of removing the old electric light plant to the new power house, which if done will require an addition to the power station. The new plant has an output of 400 hp and the old plant 200 hp. The cost of the work is estimated at $6,000. W. B. Leverich is superintendent.

ORIENT, WASH.—Plans for a $75,000 power plant at Orient by a group of Spokane men who have organized under the name of the Orient Water Power Company have been formulated and the following officers elected: Arthur Phillips, president; Col. E. D. Sanderson, vice-president; Wm. Davidson, secretary.

ROSLYN, WASH.—Application has been made to the Council by A. A. Nichols and August Sassa for a franchise for a street railway which they proposed to build from Roslyn to Cle-Elum, Wash.

SEATTLE, WASH.—Negotiations have been completed by the Seattle, Renton & Southern Railway Company for the sale of $1,000,000 in bonds, the proceeds of which will be used to take up outstanding securities, rebuilding the electric road to Renton with heavier rails, and heavier trolley wire, constructing a substation and other improvements to the system. W. R. Crawford is president of the company.

SPOKANE, WASH.—Mayor C. Herbert Moore contemplates making an investigation in regard to the question of establishing a municipal electric light plant in Spokane.

TOPPENISH, WASH.—A franchise has been granted to A. H. Campbell and M. Kramer to furnish electricity for lamps and motors in Toppenish.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company, of Portland, Ore., has secured a franchise from the County Commissioners and in a short time will supply Fruit Valley and the section east of the garrison with electricity for lamps and motors.

WATERVILLE, WASH.—The Farmers' Telephone Company contemplates the erection of a telephone line to Farmer, and also to Orondo and Entait.

ELKINS, W. VA.—Plans are being considered by the Citizens' Telephone Company for additional improvements to its plant.

KEYSER, W. VA.—A franchise has been granted to the Potomac Valley Railroad Company to construct an electric railway in Keyser. L. S. Kirker is engineer.

PRAIRIE DU SAC, WIS.—The citizens are considering the question of erecting a dam at Prairie Du Sac to develop 15,000 hp, the cost of which is estimated at $2,000,000.

STURGEON BAY, WIS.—Bids will be received until July 7 by H. C. Leonhardt, city clerk, for furnishing material and constructing an electric light plant and water works system.

SHERIDAN, WYO.—The Butte Electric Company, which recently purchased the property and water rights of the Amalgamated Copper Company, located at Parrot, is said to be contemplating the erection of a transmission line up the Jefferson Valley to Twin Bridges, and thence to Sheridan for the purpose of furnishing electricity for lamps in the latter place.

FREDERICTON, N. B., CAN.—The New Brunswick Telephone Company contemplates extending its telephone line from Prince William to Harvey Station.

SYDNEY, N. S., CAN.—J. J. Curry, city clerk, writes that the construction of a municipal electric light plant is not contemplated at the present time.

TULANCINGO, MEX.—The Landero Electric Light Company, of Tulancingo, has secured an injunction against the City Council restraining it from erecting poles along the public streets. The company is now erecting its transmission lines. The Council wishes to compel the company to place its wires underground. The power house is nearly completed and the installation of the machinery will begin shortly.

New Industrial Companies.

THE GEM ELECTRICAL COMPANY, of South Bend, Ind., has been incorporated for the purpose of carrying on a general contracting business and installing telephone systems.

THE ELECTRIC VEHICLE COMPANY, of San Bernardino, Cal., has been incorporated, with a capital stock of $20,000, by B. G. Holmes, C. S. Chestnut, W. H. and Mary M. Pettibone.

THE F. E. NEWBERRY ELECTRIC COMPANY, of St. Louis, Mo., has filed articles of incorporation, with a capital stock of $50,000. W. H. Campbell is president and F. W. Lloyd vice-president.

THE PITT ENGINEERING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000 to manufacture machinery. The incorporators are: A. A. Pitt, R. I. Phillips and John A. Brown.

THE FALCON ENGINEERING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000, by Charles B. Price, Harry R. Cowan and W. A. Powlank. The company proposes to manufacture machinery, etc.

THE NEW ENGLAND CARBON COMPANY, of Kittery, Maine, has ben chartered with a capital stock of $190,000 to manufacture carbon products. The officers of the company are: Lamont Hilton, of Portsmouth, N. H., president and treasurer, and A. B. Cole, of Eliot, Maine, clerk.

THE SOUTHERN UTILITIES COMPANY, of Norfolk, Va., has been incorporated, with a capital stock of $100,000, to contract for gas, water and electric plants. The officers of the company are W. H. Fritchman, of New York, N. Y.; G. A. Frick, of Virginia Beach, Va.; E. F. Kitson, of Norfolk, Va.

THE HURD & HAGGIN COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $80,000 for the purpose of manufacturing engines, dynamos, motors, etc. The incorporators are: Benjamin Hurd, Robert A. Shailer, of Nutley, N. J.; Arthur Seal, of New York, N. Y.

THE COMMERCIAL ENGINEERING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $150,000, and proposes to manufacture engines, motors, machinery, etc. The incorporators are: F. C. Green, W. H. Fulton and W. K. Post, all of New York.

THE ALBERTSON POWER TRANSMITTER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $250,000, by William H. Buckout, Charles E. Mallison, Robert Oppenheim, of New York, N. Y. The company proposes to manufacture machinery, mechanical devices, etc.

THE UNITED STATES AUTOMATIC LIGHTING COMPANY, of Springfield, Mass., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing lighting apparatus. The officers are: Albert W. Allen, president; Edwin F. Markham, treasurer, and George H. Mize, clerk, all of Springfield.

THE CONTINUOUS WATER POWER COMPANY, of Indianapolis, Ind., has filed articles of incorporation with the Secretary of State with a capital stock of $160,000. The company proposes to establish and equip a plant in this city for the manufacture of water power machinery. The directors are William B. Gray, George Fox and Francis McCay. The local agents are Clark & Clark, of Indianapolis.

THE PRICE McKINLOCK COMPANY, of Saco, Maine, has been organized with a capital stock of $100,000, for the purpose of doing a general manufacturing and mercantile business, especially to manufacture and deal in electric and gas appliances. The officers of the company are: Frank S. Price, of Salem, Mass., president; Alton F. Tupper, of Arlington, Mass., treasurer, and Luther R. Moore, of Saco, Maine, clerk.

New Incorporations.

BENSON, ARIZ.—The San Pedro Valley Telephone Company has been organized and the following officers elected: H. K. Street, president; Edward Morrison, secretary and treasurer, and M. W. Merrill, manager. The company proposes to take over the telephone line of the Boquillas Land & Title Company and operate it in connection with the system it is planning to install.

SELMA, CAL.—The Selma Farmers' Telephone Association has been organized and the following named officers elected: Alyn O. Taylor, president; John H. Peak, vice-president; S. L. Heisinger, secretary and treasurer. It is reported that the company contemplates taking over the local system. If it does not, a new system will be installed.

CHICAGO, ILL.—The McHenry Electric Service Company has been incorporated with a capital stock of $25,000, by G. K. Paige, L. Howell and P. J. Boonstra, of Chicago. The company proposes to operate an electric light and power plant.

CHICAGO, ILL.—Articles of incorporation have been filed for the Vincennes, Centralia & St. Louis Transit Company by M. A. Peoples, J. J. Burns, Clyde F. Burns, Dennis O'Connor and J. E. Burns, all of Chicago. The company is capitalized at $30,000 and proposes to construct an electric railway from Lawrenceville to East St. Louis, Ill. Burns & Company, of Chicago, Ill., will have charge of the construction of the railway and will award all contracts.

ALEXANDRIA, IND.—The Southwestern Alexandria Telephone Company has been incorporated with a capital stock of $5,000, by James Wright, Andrew Berg, J. W. Reeves, Lawrence Hollowell and Milton E. Blacklidge.

BLUFFTON, IND.—The Bluffton, Berne & Celina Traction Company is being organized to construct a railway to connect the above-named cities.

ORIENT, IA.—Articles of incorporation have been filed for the Orient Telephone Company with a capital stock of $10,000.

TOPEKA, KAN.—The Home Telephone Company has been incorporated with a capital stock of $50,000, by W. E. Burns, of Hutchinson; W. P. Hemphill, of Topeka; C. L. Brown, of Abilene, and A. T. Rogers, of Beloit.

GLENWOOD, MICH.—The Lake Amelia Telephone Company has been incorporated with a capital stock of $3,000, by E. D. Hunt, William von Lillienthal, E. L. Wright, H. E. West, Simon Huchins, B. A. Faulkner and James Hanrahan.

THIEF RIVER FALLS, MINN.—The Minnesota Air Line Railway Company has been incorporated with a capital stock of $500,000 to construct an electric railway from Thief River Falls to Roosevelt and ultimately to Zipple Bay. The officers of the company are: William F. Hunt, of Roosevelt, president; T. R. Hasler, Iowa Falls, Ia., vice-president; E. E. Rambusch, of Roosevelt, secretary.

ADAMS, NEB.—The West Maple Telephone Company has been chartered, with a capital stock of $1,000, by Thomas Brothers, Frederick Streba and others.

MILLIGAN, NEB.—The Belle Telephone Company has been organized by the business men of the city to install a local telephone system.

OMAHA, NEB.—Articles of incorporation have been filed for the Long Distance Independent Telephone Company. The company is capitalized at $10,000, and the officers are: T. C. Williams, of Farlin, Ia., president; C. C. Lundy, of Cooper, Ia., vice-president; D. V. Study, of Jefferson, Ia., secretary and treasurer.

PAVILION, N. Y.—The Pavilion Telephone Company has been incorporated with a capital stock of $10,000, by B. J. Berard, of Pavilion, N. Y.; G. Dean Hudson, Horace S. Bradley, of Wyoming, N. Y., and others.

DURHAM, N. C.—Articles of incorporation have been filed for the Suburban Land & Power Company, with a capital stock of $40,000, by E. J. Parrish, J. M. Gregory, John Sprunt Hill and others. The company proposes to construct and operate an electric railway in and around Durham, and will also furnish electricity and gas.

RUTHERFORDTON, N. C.—The Green River Telephone Company has been incorporated with a capital stock of $10,000, by John C. Mills, Poe W. Eskridge and E. B. Quinn, of Rutherfordton.

CATOOSA, OKLA.—The Bridges Telephone Company has filed articles of incorporation with a capital stock of $2,500. The officers of the company are: J. C. Smith, president and J. M. Adkinson, secretary.

OKLAHOMA CITY, OKLA.—The Crescent Gas & Electric Company has been organized with a capital stock of $25,000 by A. A. Klein, B. M. Kahn, F. B. Owen, H. G. Snyder and E. Bancroft, of Oklahoma City.

CANBY, ORE.—The Molalla Power Company has been incorporated, with a capital stock of $10,000, by John B. W. S. and Fred P. Hurst. The company proposes to utilize the waters of the Molalla River and its tributaries at or near Canby to generate electricity, and also for domestic and irrigation purposes. The main power plant will be located in Canby.

MEADVILLE, PA.—Articles of incorporation have been filed for the Crawford Mutual Telephone Company with a capital stock of $50,000.

SHIPPINGPORT, PA.—The Raccoon Township Telephone Company has been incorporated with a capital stock of $5,000. The company proposes to install a local telephone system.

BERESFORD, S. D.—The Beresford Telephone Company has been incorporated with a capital stock of $50,000.

CUSTER, S. D.—The Point of Rocks Telephone Company has been incorporated with a capital stock of $25,000, and proposes to construct and operate a telephone system throughout the southern Black Hills country. The company is capitalized at $25,000, and the incorporators are John Ziement, Charles Pringle, Robert McAdams and others.

LEXINGTON, TENN.—The Home Telephone Company has been formed to install a local telephone system, to cost about $2,600. A committee consisting of Mayor C. G. Gathings, chairman, E. L. Fesmire, secretary, W. W. Sweatt and John Williams, has been appointed to attend to the details.

CLAIRMONT, TEX.—Articles of incorporation have been filed for the Luzon Telephone Company with a capital stock of $25,000 by S. A. McCombs, T. G. Harkey and H. M. Kelly.

EL PASO, TEX.—The Mesa Valley & El Paso Railway Company has been organized, with a capital stock of $1,000,000, for the purpose of constructing an electric railway between El Paso and Las Cruces, a distance of 44 miles.

ELLENSBURG, WASH.—The North Kittitas Telephone Company has been formed. The officers of the company are: J. H. Moore, president; N. W. Gehlen, secretary, and N. Rollinger, treasurer.

HARRISVILLE, W. VA.—The Berea & Slab Telephone Company has been incorporated with a capital stock of $10,000, by Newton Low, William Hall, George Ammick, George Leyfield, of Cairo, W. Va., and Jacob Hatfield, of Harrisville.

BRUCE, WIS.—The Amacoy Telephone Company has been chartered with a capital stock of $1,000 to install a local telephone system. E. C. Campbell, B. Stevens and others are interested in the enterprise.

CALEDON, ONT., CAN.—The Caledon Telephone Company has been chartered with a capital stock of $10,000.

DUNDEDIN, ONT., CAN.—The Noisy River Telephone Company has been chartered with a capital stock of $10,000.

NORTH AUGUSTA, ONT., CAN.—The Leeds & Grenville Independent Telephone Company has been chartered with a capital stock of $40,000.

SUNDERLAND, ONT., CAN.—The Sunderland Telephone Company has been incorporated with a capital stock of $10,000.

Personal.

MR. C. L. EDGAR, president of the Boston Edison Company, has gone abroad for rest, recreation and study, and will not return from Europe before the end of September.

MR. J. G. WHITE, president of the J. G. White Co., of New York City, has sailed for England, by a recent steamer, to attend to various important business matters on the other side.

DR. C. J. H. WOODBURY.—Dartmouth College conferred on Mr. C. J. H. Woodbury, at its Commencement, June 24, the degree of Doctor of Science, this being the second time that he has received the honor, the first degree being from Union College, New York, in 1906.

MR. PERCY WHEELER, managing director of the Metropolitan Amalgamated Railway Carriage & Wagon Company, Ltd., of Birmingham, has been visiting this country, accompanied by two of his managers. He attended the railway convention at Atlantic City last week, but has returned home by *Carmania* this week, to escape the hot weather. The members of his staff have gone to Pittsburgh and Chicago, and will visit one or two other points before their return to England.

MR. R. H. KLAUDER, formerly engineer of the Philadelphia office of the Nernst Lamp Company, and until recently production manager for the General Storage Battery Company, has opened an office in the Commercial Building, Philadelphia, as consulting engineer. Mr. Klauder will continue to specialize on illuminating and storage battery work and will represent in Philadelphia the United States Arc Lamp Company, of Brooklyn, and the General Storage Battery Company, of Boonton, N. J.

Trade Publications.

TUNGSTEN LAMPS rated at from 22 cp to 100 cp are described in an illustrated bulletin recently issued by the Electrical Accessaries Company, 1135 Broadway, New York. These lamps consume 1.25 watts per candle.

WIRE-MAKING APPLIANCES.—The Frank Mossberg Company, of Attleboro, Mass., has just issued a special catalogue covering metal reels, spools and beams for wire manufacturing, as well as for the textile uses.

HOLOPHANE GLOBES AND REFLECTORS.—The Holophane Company has issued a number of new price sheets, to supersede other sheets in the Holophane Data Book. The sheets are in Division A, Section 101, and numbered 0, 00, 1 to 9.

LAMP-TESTING WATTMETER.—The Electrical Accessaries Company, 1135 Broadway, New York, has issued a leaflet dealing with its socket type wattmeter for determining the power consumption of an incandescent lamp. The instrument can be used for either direct or alternating current.

HUBBELL ATTACHMENT PLUGS.—With the title "Convenient Currents," Harvey Hubbell, Inc., Bridgeport, Conn., has issued a handsome illustrated catalogue, illustrating and showing various uses of Hubbell interchangeable attachment plugs. The attractive illustrations show household interiors, indicating the manner in which the plugs are applied to various domestic uses.

HARVARD "DOPE."—The Harvard Electric Company, 66 West Van Buren Street, Chicago, Ill., and 136 Liberty Street, New York City, has just issued the June number of "Harvard Dope," the Harvard Electric Company house organ. This number is devoted almost exclusively to telephone specialties made by the Harvard company. The Harvard self-welding wire joint takes two pages to fully describe its merits. Telephone fuses and lightning arresters are fully illustrated.

SUNBEAM LAMPS.—The Western Electric Company has recently gotten out a wall circular descriptive of the various types of Sunbeam lamps distributed by them. This will be found useful by dealers, contractors and central stations to hang up for reference, as it is more convenient to refer to than catalogues. The circular covers all the standard types of Sunbeam lamps on the market, such as battery, miniature, candelabra, round bulb, tubular, reflector, stereopticon, train lighting, street series, Gem, tantalum, tungsten, etc.

TRANSFORMER ENGINEERING.—The Central Electric Company, Chicago, Ill., is distributing a new circular containing engineering data on the economy of the new "silico-vanadium" steel used in the Pittsburg transformers, and showing the difference between "high-efficiency" and "standard-efficiency" transformers on a "dollars and cents basis." In computing core loss costs, the author has adopted one cent per kw-hour as the basis, and a comparison is made between the actual cost of the "high-efficiency" and "standard-efficiency" transformers.

Unclassified Items.

(Items received too late to classify under Construction News, etc.)

MIDDLEBORO, MASS.—Plans are being made to install a 15-hp electric motor at C. P. Washburn's grain elevator. Electricity for operating the motor will be furnished by the municipal electric light plant.

NEWBURGH, N. Y.—Arrangements are being made to connect Newburgh, Kingston and Poughkeepsie with transmission lines, electricity to be supplied from the power plants at Honk Falls, near Ellenville, and High Falls. Electrical energy for lighting Kingston is already being supplied from the Honk Falls plant. It is expected to have the plant at High Falls in operation by Oct. 1, from which electricity will be transmitted to New Paltz, where the old plant of the New Platz Electric Light Company will be fitted up as a substation. By combining the two plants it is expected to have available power for operating the system of the three cities for 10 months in the year. It is proposed to connect the steam electric power plants of Kingston, Newburgh and Poughkeepsie so that they will be available in cast of emergencies. The rights of way for the transmission lines in the southern part of Ulster County have been taken in the name of the Hudson Counties Gas & Electric Company.

RAYMOND, WASH.—At the annual meeting of the South Bend-Raymond Electric Company the following named officers were elected: J. L. Meyers, of South Bend, president; P. H. Ridgeway, of Seattle, vice-president and manager; R. L. Fisher, of Seattle, secretary and treasurer.

PUEBLO COL.—The directors of the Colorado & Kansas Power & Transmission Company have elected the following named officers: S. H. Atwater, of Canon City, president; Henry Warner, of Garden City, Kan., vice-president; W. O. Bourne, of Dodge City, Kan., treasurer, and E. W. Plamer, of Pueblo, Col., secretary.

BRECKENRIDGE, MINN.—D. J. Jones, city clerk, will receive bids for 1000 incandescent lamps.

SAN JOSE, CAL.—The Board of Supervisors has granted the Toulumne Water Power Company a 50-year franchise to erect transmission lines on the public roads of the county, in return for which the company is to pay the county 2 per cent of the gross receipts after the expiration of five years.

MONTREAL, QUE., CAN.—Orders have been placed by the Central Heat, Light & Power Company, through Laurie & Lamb, of Montreal, consulting engineers, for a 430-hp Belliss engine for its power house located on St. Peter Street in this city.

GUELPH, ONT., CAN.—The Light and Power Commission has decided to make a reduction in the price of gas and electricity, which will take effect at once. The price of electricity for commercial purposes has been reduced from 12 cents to 10 cents per kw-hour and the residential rates will remain at 10 cents. The rate for street lamps will be reduced from $65 to $60 per lamp per year. The reduction will mean a saying of from $14,000 to $15,000 per year.

CALGARY, ALB., CAN.—Orders have been placed by the city with the Robb Engineering Company, of Amherst, N. S., for a 1100-hp Robb-Armstrong cross compound Corliss engine, to be arranged for direct connection to a 750-kw Bullock generator for the municipal electric light plant.

REGINA, SASK., CAN.—The Canadian Pacific Railroad Company is planning to install its own lighting plant in the local station and yards, work on which, it is said will commence at once.

MINNEAPOLIS, MINN.—Mayor J .C. Haynes has vetoed the ordinance passed by the City Council June 12, granting the Minneapolis General Electric Company a 30-year franchise.

LA CROSSE, WIS.—The La Crosse Gas & Electric Company has surrendered all of its local city franchises and has made application for an indeterminate permit to operate under the state laws of 1907. This action, it is thought, will relieve the company of its obligations to the city administration and the necessity of applying for new franchises when the present franchises expire. By this action the company surrenders the franchise of the Central Electric Company, the merchants' company, which was leased by the La Crosse Gas & Electric Company, and puts that corporation out of business. By the surrender of its franchise the State Railroad Commission will fix the conditions under which the company will do business.

EAU CLAIRE, WIS.—Arrangements are being made by the Rice Lake Milling & Power Company to build a new power plant. Contracts have been awarded for a 275-hp turbine wheel to James Leffel & Company, of Springfield, Ohio; to the General Electric Company, of Schenectady, N. Y., for a 160-kw generator; the structural steel work to the Illinois Steel Company, Chicago.

Business Notes.

MR. T. J. COPE, the well known conduit engineer, expects to have completed by July 15 his extensive contract for testing and cleaning all ducts in the Market Street Subway, of The Philadelphia Rapid Transit Company.

MR. FRED W. NASON, 39 Cortlandt Street, New York, has taken over the agency of "Rex" outlet boxes, manufactured by the Wm H. Colgan Company, West Newton, Mass. Mr. Nason also handles Condit circuit-breakers and oil switches, and M. & M. flush switches, receptacles and plugs.

LAMPS IN SOUTH AFRICA.—The Sunbeam Incandescent Lamp Company, New York City, has received a letter recently from one of its correspondents in South Africa giving an indication of the relative value attached there to American tungsten lamps as compared with others. He says: "I have just heard from one of my customers for whom you furnished the only lot of tungsten lamps for me, to the effect that these lamps are the best on the market. In spite of the higher price, he is ordering some more. This I am extremely glad to hear, and I hope that, as a result of the trial he has given them, a good market for the lamps out here may result. The lot which you furnished me came out with very slight breakage. In fact, there were only six lamps out of the 150 which were broken in transit or in any way defective."

FOSTORIA INCANDESCENT LAMP COMPANY.—The factory of the Fostoria Incandescent Lamp Company is now undergoing extensive alterations and enlargement. In addition to this, the construction is being strengthened throughout on account of the manufacture of tungsten lamps. Heavier material, including heavy maple flooring, etc., is being installed, and when the work is finished the factory will not only be practically as good as new, but have a considerably larger production and correspondingly better equipment. The annual summer conference of the company's salesmen was recently held at Ballast Island in Lake Erie, near Put-in Bay. It was attended by about 25 representatives from all parts of the United States and an extensive programme was considered. This meeting was especially important on account of being the first held since the high-economy units have been commercially perfected.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City. Next meeting in September.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, October, 1908.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Street & Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont. Next meeting, Atlantic City, N. J., Oct. 12-16.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, United Engineering Societies Building, 29 West 39th St., New York.

American Society of Municipal Improvements. Secretary, A. Prescott Folwell, Room 512, Flatiron Building, New York. Next meeting at Atlantic City, N. J., October 13.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., Oct. 12-16.

Association of Edison Illuminating Companies. Assistant Secretary, S. E. Mumford, Detroit, Mich.

Association of Electrical Engineers of the Iron and Steel Industry. Secretary, G. H. Winslow, Frick Annex, Pittsburg, Pa.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Iron and Steel Electrical Engineers. Secretary G. H. Winslow, National Tube Company, Pittsburg, Pa.

Association of Railway Telegraph Superintendents. Secretary P. W. Drew, Room 511 Harvester Building, Chicago.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Sept. 24, 1908.

Chicago Electric Club. Secretary, S. M. McFedries, care J. L. Schureman & Co., Chicago.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, November 5.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau St., New York. Next meeting in October.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and Thirty-second St., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Detroit, Mich., Aug. 19, 20 and 21, 1908.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Grand Rapids, Mich.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting at Pittsburg, Kan., October 8 and 9.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Grand Rapids, Aug. 18-21.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

MISSOURI ELECTRIC LIGHT, GAS & STREET RAILWAY ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. W. Freeman, Brooklyn Edison Company, Brooklyn, N. Y. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y. Next meeting at Chicago, July 15.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting at Philadelphia, June 11.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1909.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Aug. 25, 26 and 27, 1908.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, W. A. Rowe, Citizens' Building, Cleveland, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Niagara Falls, Sept. 16, 17 and 18.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in February, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 23, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

891,232. LIQUID RHEOSTAT; Herbert W. Cheney, Norwood, Ohio. App. filed Oct. 31, 1906. Comprises a tank having triangular plates which dip more or less beneath the surface of the liquid so as to establish a circuit of varying resistance. The plates are capable of dipping into the liquid to a point where they engage stationary contacts to complete the circuit.

891,236. ELECTRIC MOTOR CONTROLLER; John Dillon, Milwaukee, Wis. App. filed June 24, 1904. A means for controlling an electric motor of the type adapted to frequent starts, stops and large powers. It is particularly designed for electric elevator mechanism to start, stop, reverse and running speed conditions of elevator car having a push-button controller.

891,241. METHOD OF AND MEANS FOR STARTING DYNAMO ELECTRIC MACHINES; Budd Frankenfield, Norwood, Ohio. App. filed Jan. 31, 1907. A means for starting and bringing into synchronism electric motors and rotary converters. Has an auxiliary driving source of varying speed, and automatic means for connecting the machines in circuit when the speeds are synchronous.

891,248. SMELTING-FURNACE; Eugen Assar Alexis Grönwall, Ludvika, Sweden. App. filed May 1, 1906. Covers details of a furnace for heating, smelting or reducing materials, such as ore in various forms, in which is effected an oxidation of carbon monoxide.

891,254. ELECTRICAL WATER-HEATER; Harry M. Hill, St. Louis, Mo. App. filed July 29, 1907. An electrical water-heater having a shell containing an electrode, a post for supporting said electrode in position in said shell and means on said post for adjusting said electrode.

891,263. ELECTRICAL APPARATUS; Charles Julius Klein, New York, N. Y. App. filed May 7, 1907. Comprises a plug receptacle provided with closure means opening inwardly of the box and operated by the insertion of the plug.

891,264. DEVICE FOR THE PURIFICATION OF METALS; Charles T. Knipp, Urbana, Ill. App. filed Aug. 7, 1906. Has means for generating an electro arc in vacuo and vaporizing the metal thereby, together with means for condensing the vapor and separating the metal distillate.

891,265. PROCESS FOR PURIFICATION OF METALS; Charles T. Knipp, Urbana, Ill. App. filed Aug. 6, 1907. Relates to modifications of the above.

891,273. CLAMPING MEANS FOR CORE PLATES OF DYNAMO ELECTRIC MACHINES; Charles E. Lord and William H. Powell, Norwood, Ohio. App. filed Sept. 14, 1905. A means for keying the laminae securely to the shaft of an electric generator. Has a ring inset in a groove of the shaft to prevent longitudinal displacement of the collars which clamp the laminae.

891,282. SPEED LIMITING DEVICE; Anthony L. McHugh, Cincinnati, Ohio. App. filed Aug. 9, 1905. An electric contact device adapted to act at predetermined speed on a rotating shaft. Makes use of a spring plunger which moves radially to engage a contact when a predetermined speed is exceeded.

891,303. SIGNALING SYSTEM FOR RAILWAYS; Louis H. Thullen, Edgewood Park, Pa. App. filed June 9, 1906. Block signal system of the type having one continuous rail and another interrupted rail, the sections being energized by direct current, and an alternating current being used for power purposes. Makes use of a type of relay which is responsive only to direct currents.

891,316. DYNAMO ELECTRIC MACHINE; Robert B. Williamson, Norwood, Ohio. App. filed July 30, 1906. A construction of commutator for dynamo electric machines making use of segments having clamping means intermediate the ends thereof and means for shifting said clamping means from the interior of the support.

891,320. INDUCTION COIL; Donald H. Yost, York, Pa. App. filed Oct. 23, 1907. In place of the usual interrupter, patentee has a wholly inclosed vibrator and means for longitudinally displacing the entire core of the coil for the purposes of adjustment.

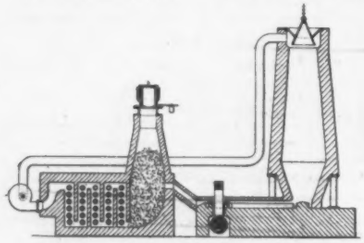
891,323. FUSE; Bert A. Brown, Churchville, N. Y. App. filed June 13, 1907. A fuse cartridge, including a form of fan which spreads out to produce a visual signal in case the fuse blows.

891,339. RAILWAY SIGNAL; Franz Hirt, Berlin, Germany. App. filed Dec. 11, 1907. Has a selenium cell which is arranged in circuits so as to be responsive only to polarized light, and the train carries a source of properly polarized light adapted to cause a signal.

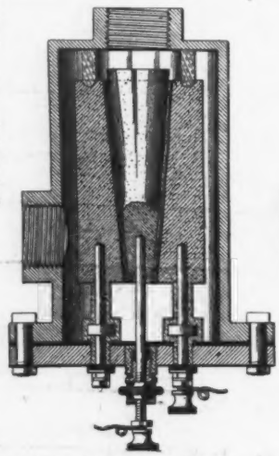
891,343. FLEXIBLE ELECTRICAL CONNECTION DEVICE AND THE LIKE; Charles Albert Keller, Paris, France. App. filed Dec. 7, 1907. A pair of sinuous conductors, formed of flat resilient leaves, are connected together at spaced points so as to permit a longitudinal extension by the straightening out of the sinuosities.

891,350. GENERATION AND TRANSMISSION OF MOTIVE POWER; George William Mascord, London, England. App. filed Feb. 17, 1908. Has a supplemental motor and automatic means for clutching the supplemental motor to the driving shaft when more than a certain power is required.

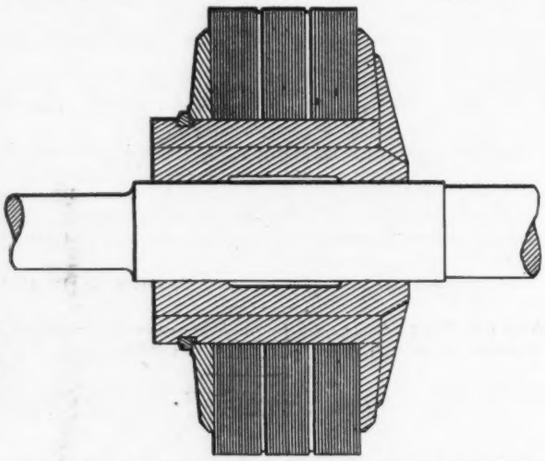
891,352. TOWING SYSTEM; Wilbur Merrill, Schenectady, N. Y. App. filed Feb. 9, 1907. Has means for paying out a hawser in case the speed of the towboat is suddenly increased, and includes devices for taking up the amount paid out subsequently, all governed automatically.



891,248—Smelting Furnace.



891,254—Electrical Water Heater.



891,273—Clamping Means for Core Plates of Dynamo Electric Machines.

891,361. MEANS FOR ELECTROPLATING RODS, PIPES, ETC.; Daniel Hayes Murphy, New Castle, Pa. App. filed Oct. 30, 1907. A form of electroplating tank making use of specially constructed fixtures and connections for electroplating pipes on the inside.

891,400. ELECTRIC HEATER AND MEANS FOR CONTROLLING THE SAME; Peabody A. Brown, Denver, Col. App. filed Aug. 20, 1906. A construction of flatiron having a series of spools inclosed within its interior and wound with spiral coils which are controlled by a thermostat.

891,410. TROLLEY FOR ELECTRIC CARS AND THE LIKE; Edward J. Dacey, Prescottville, Pa. App. filed Oct. 11, 1907. In place of the usual harp, patentee has a vertically arranged cylindrical casing in which is contained a depressible plunger. The wheel is supported on the plunger and is cushioned in its movement thereby.

891,414. THERMAL CUT-OUT; Charles A. Ernst, Schenectady, N. Y. App. filed April 6, 1904. A means by which the flash of the auxiliary wire of an indicating fuse is so confined as to prevent danger of fire by the hot metallic particles.

891,425. LIMIT SWITCH DEVICE; Sam H. Kanmacher, Schenectady, N. Y. App. filed Dec. 18, 1905. A form of controller designed to bring the motor to rest after it has made a predetermined number of revolutions in one direction or in either direction.

891,455. HOT WATER HEATER; George L. Bennett, Trenton, N. J. App. filed April 4, 1907. In place of the usual faucets, patentee has turn-cocks with switch contacts so as to complete a circuit through a resistance wire spirally contained in the inlet pipe for the faucet.

891,463. ELECTROTHERMAL PROTECTOR; Frank B. Cook, Chicago, Ill. App. filed May 23, 1907. A thermal protector for telephone circuits of the type having spring blades which are maintained in open-circuited relation by small cartridges or plugs which collapse when subjected to an excessive temperature.

891,496. ELECTRICAL TRANSFORMER; August R. Luschka, River Forest, Ill. App. filed Dec. 11, 1905. In place of the usual secondary, patentee has a secondary of X-shape in transverse section designed to give a longer spark with less energy expenditure.

891,561. COMBINED ELECTRIC SERVICE CUT-OUT AND METER BOARD; Henry E. McGowan and Edwin R. Ellsworth, New York, N. Y. App. filed Oct. 21, 1907. Combined electric service cut-out and meter board designed to economize wall space and provide an apparatus in which the electric circuit may be electrically operated directly at the meter, and manually by suitable operating switches.

891,565. PROCESS OF REDUCING METALLIC OXIDS; Edgar F. Price and Frederick M. Becket, Niagara Falls, N. Y. App. filed Aug. 5, 1907. Process of reducing metallic oxids which consists in reacting thereon simultaneously with calcium carbid and silicon carbid.

891,589. AUTOMATIC ELECTRIC REGULATOR; William Lord Bliss, New York, N. Y. App. filed Aug. 24, 1904. An automatic electric regulator designed to confine the output of a generator within certain limits where said generator operates under such conditions that the electromotive force developed thereby tends to vary.

891,617. ELECTRIC SWITCH-OPERATING MACHINE; Leslie A. Hedger, Mill Valley, Cal. App. filed Jan. 7, 1907. Has an oscillating switch arm which is moved between two extreme positions by a solenoid and spring connection. The engagement of the solenoid is made through a cam so as to cause an abrupt movement.

891,619. SYSTEM OF ELECTRIC TRACTION; Samuel H. Hoopes, Jr., West Chester, Pa. App. filed Aug. 10, 1907. Patentee has a plurality of rods joined together beneath the car bodies in place of the usual collector shoe, and which engage stationary trolley wheels between the track rails.

891,627. ALARM DEVICE; George W. MacKenzie, Ban Avon, Pa. App. filed Nov. 30, 1907. Makes use of an air chamber having a diaphragm which is caused to move, in case of undue expansion of the air, to close an alarm circuit.

891,632. ELECTRIC BRAKE MECHANISM FOR CARS, ELEVATORS, CRANES, AND OTHER PURPOSES; Michael E. Neenan, New York, N. Y. App. filed March 22, 1905. A brake mechanism in which the brakes are released or retracted by an electromagnetic appliance adapted to apply the brakes in conjunction with the usual hand devices.

891,657. APPARATUS FOR THE ELECTRICAL PRODUCTION OF HEAT FOR COOKING AND OTHER PURPOSES; Arthur F. Berry, Ealing, England. App. filed Aug. 9, 1906. A form of transformer adapted to be included in flatirons and kitchen utensils and having a secondary circuit designed to transmit its heat to the surface of the device.

891,712. TROLLEY; Abel Molnar, Pittsburg, Pa. App. filed March 14, 1908. The arms of the trolley harp extend above the usual wheel and have upwardly extending prongs or projections to close over the trolley wire.

891,720. MOTOR CONTROLLING DEVICE; William C. O'Brien, Baltimore, Md. App. filed Jan. 28, 1908. A switch for operating electric motors which have to be frequently stopped and started and operated at varying speeds. Has a reversing switch and rheostat operable by connections from a single arm.

891,721. STARTER FOR ELECTRIC MOTORS; William C. O'Brien, Baltimore, Md. App. filed Nov. 22, 1907. Relates to modifications of the above.

891,722. STARTER FOR ELECTRIC MOTORS; William C. O'Brien, Baltimore, Md. App. filed Feb. 14, 1908. Covers further modifications.

891,743. FIRE AND TEMPERATURE ALARM OR INDICATOR; George Lawrence Smith, Aberdeen, Scotland. App. filed March 19, 1908. Details of a thermal circuit closer having a chamber with a diaphragm which moves between a pair of stationary contacts depending upon a preponderance of pressure on its respective sides.

891,779. ELECTRICALLY GOVERNED, AUTOMATICALLY OPERABLE, TRAIN-CONTROLLING SYSTEM; Harvey B. Miller, Staunton, Va. App. filed Oct. 10, 1907. The locomotive has a tappet which will establish mechanical and electrical connection with contact plates included in circuit along the track.

891,784. SINGLE-PHASE COMMUTATOR MOTOR; Stanley S. Seyfert, South Bethlehem, Pa. App. filed Jan. 31, 1905. An alternating-current commutator motor, comprising the combination of an external armature, a commutator therefor, and an internal uncommutated field.

891,786. TELEPHONE SYSTEM; Nathan H. Suren, Highlandville, Mass. App. filed March 16, 1906. In a signal system, the combination with a lighting circuit including a lamp, and a telephone circuit including a telephone, of a box, the telephone being inside of the box, means within the box for affecting the lamp, and a drying device within the box, the said drying device being in the form of a resistance in multiple with the clamp and within the lighting circuit, and receiving current therefrom.

891,792. CAR STOP AND SPEED SIGNAL; Joseph F. Bush, Schenectady, N. Y. App. filed Nov. 20, 1907. Patentee provides a plurality of tail lights for a train which will automatically exhibit in different combinations depending upon the condition of the train, that is, whether it is in motion or at rest, and at what speed.

891,797. METHOD OF AUTOMATIC REGULATION OF RECTIFIERS AND ROTARY CONVERTERS. Francis B. Crocker, New York, N. Y. App. filed July 25, 1904. The method of regulating electric circuits which consists in introducing in the main circuit inductance set up by the combined effects of alternating and direct currents, which latter constitutes the load current, substantially as described.